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Whole No.
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August
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EDITORIAL, ADVERTISING & GENERAL OFFICES:

230 Fifth Avenue, New York City

Published by Experimenter Publishing Company, Inc., (H. Gernsback, Pres.; S. Gernsback, Treas.; R. W. DeMott, Sec'y.)
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ALL accepted contributions are paid for on publication. SCIENCE AND INVENTION Monthly. Entered as second class matter May 10, 1924, at the Post Office at New York, N. Y., under the act of March 3, 1879. Additional entry at Dunellen, N. J., and San Francisco, Calif. Title Registered at the Patent Office.

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SCIENCE AND INVENTION is for sale at all newsstands in the United States and Canada. European Agents, S. J. Wise Et Cie, 40, Place Verte, Antwerp, Belgium.

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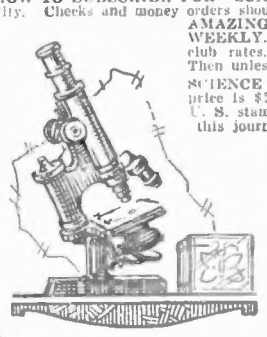

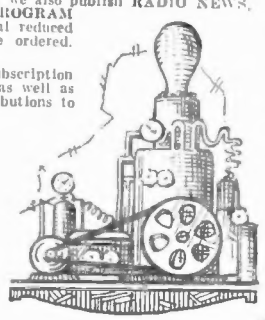

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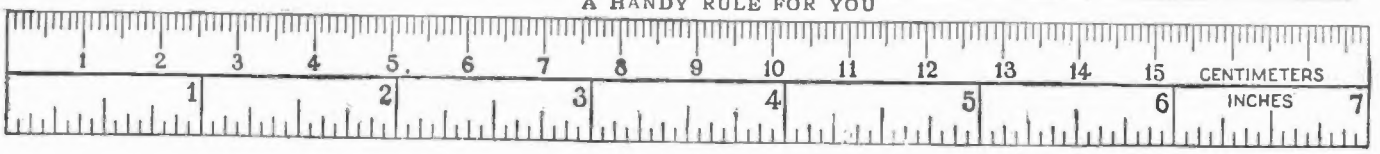

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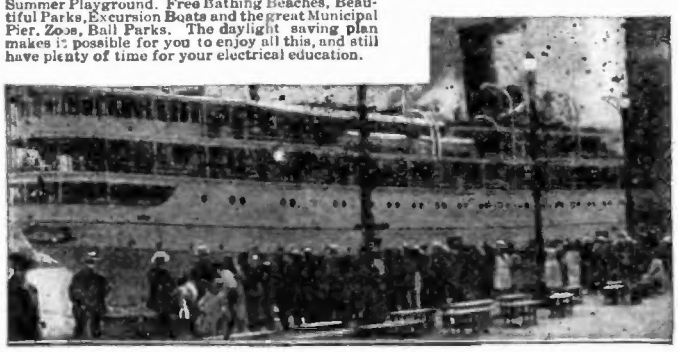

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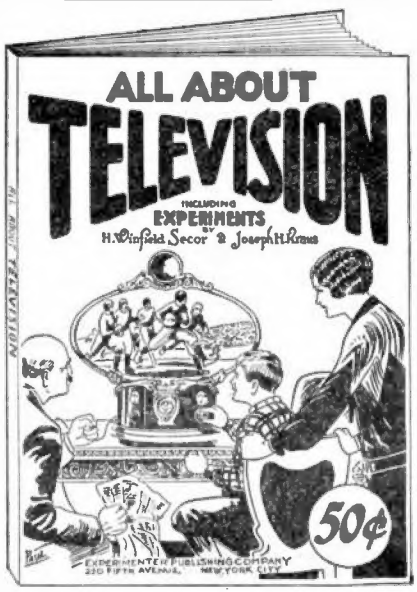

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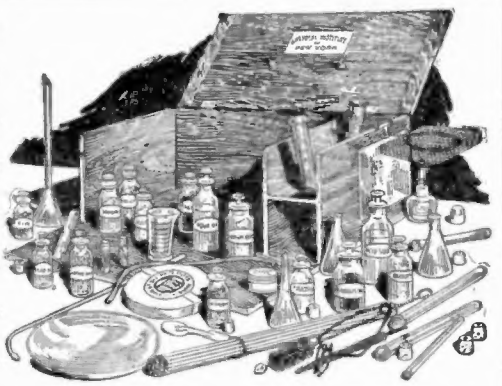

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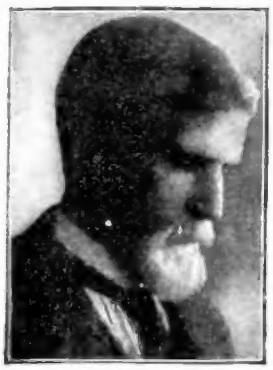

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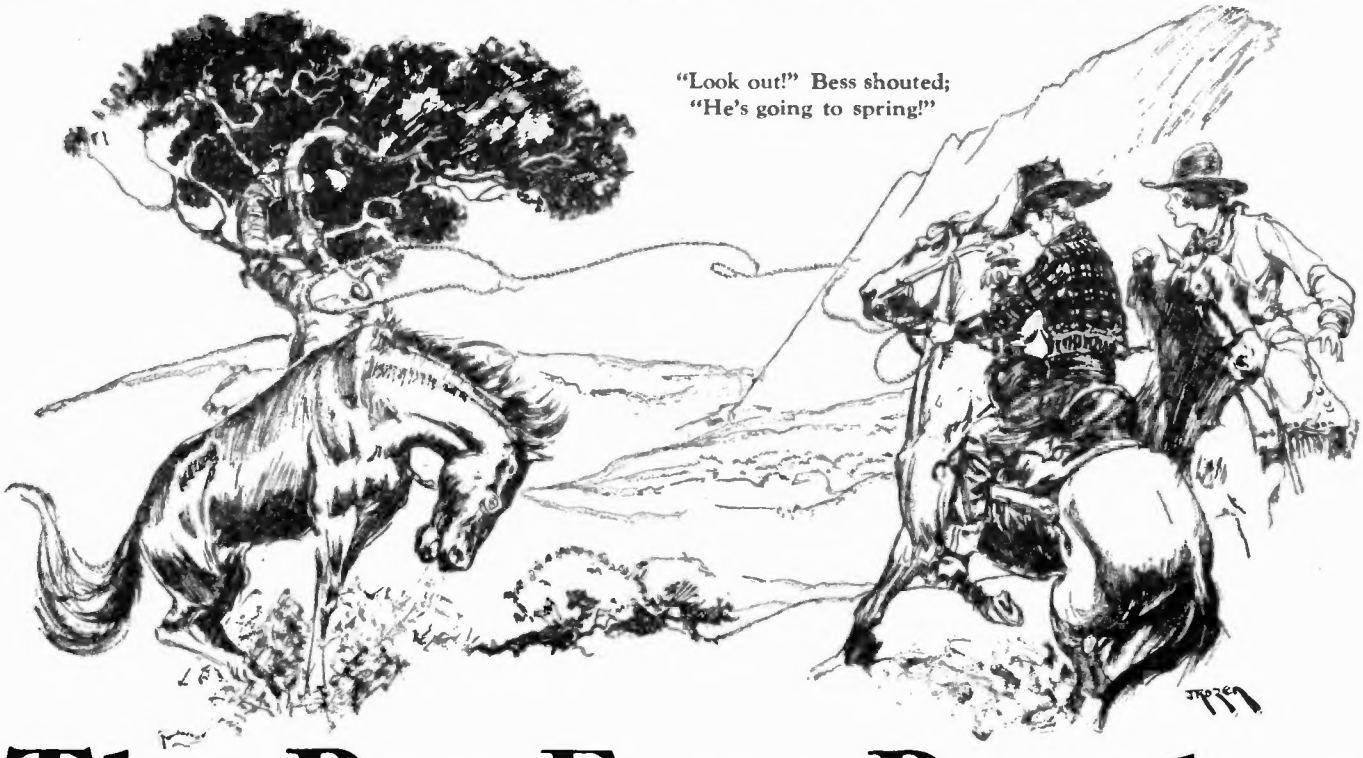

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By G. W. BARRINGTON

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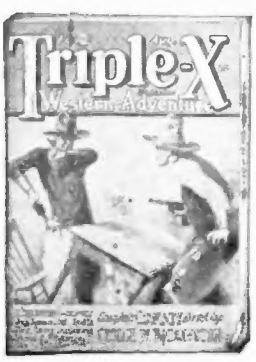

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Volume XV
Whole No. 172

Science and Invention

August, 1927
No. 4

HUGO GERNSBACK, *Editor-in-Chief*
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Editorial and General Offices, - - - 230 Fifth Avenue, New York

"Those Who Refuse to Go Beyond Fact Rarely Get As Far As Fact" - - - HUXLEY

WHAT IS MUSIC?

By HUGO GERNSBACK

THE word "music" is from the Latin "musica"—which is derived from "the muses." Philosophers tell us that music is really a mode of motion, unsatisfying as such an explanation may be. Music, as the human being understands the term in the concrete, is something totally different from music as understood by a dog or by a rabbit. Both the human being and the animal *hear* the music through their auditory nerves, but the effect on the two is widely different.

In the human being, music creates mental images in a diversified degree, whereas it may be doubted if such images are created in the brain of the lower animal. Even in human beings the effect of music is not the same on all individuals. Music which may move one person to his very depths may leave others cold. For instance, occidental music gets no response from the Chinese, whereas the same music seems to stir the Australian aborigines.

To understand what music really is, we must first go back to the dawn of the human race. Perhaps the earliest form of music was the tom-tom. The human race probably drummed first, although some authorities seem to think that a sort of chant or singing preceded the drumming.

Music, in its last analysis, is nothing but an expression of emotion by the one who makes the music, and a similar emotion is felt by the one who listens to it; always providing that the musician and the listener to the music are on a similar æsthetic plane. By this is meant that if a cultured American listens to the tom-tom of an African aborigine, the latter may derive a lot of satisfaction, which he can not communicate to the American, simply because the two are living on different æsthetic planes. Contrariwise, the most beautiful sonata played on a violin will probably not stir the African's soul the same as that of an American or European. It may be said that music distinctly shows the civilization of a given race, because the more musical and the more appreciative of music a race becomes, the higher its plane and the farther it has ascended.

Music, as we recognize the term; that is, rythmic music, and particularly melody, is of comparatively recent origin. It may be doubted if people as far advanced as the Greeks and the Romans knew anything about melodic music. No attempt had ever been made to write down music, and nothing has come down to us from antiquity, whereby we might believe that there were even simple melodies in those days.

Before the Greeks and Romans, possibly nothing but the tom-tom sort of music and the chant existed. This was the case, possibly, for millions of years, until comparatively recent biologic times, or 4,000 to 5,000 years ago.

The first real attempt to write down music and systematize it, was made in the middle ages, after which music advanced by leaps and bounds.

A peculiar thing about music is that when a composer writes in advance of his age, his music is frequently not understood at all, because the general level of musical æstheticism has not risen to the plane of the composer. An illustration of this would be Richard Wagner, who was not recognized for many years; simply because contemporary individuals in general had not yet ascended to a sufficiently high level to understand Wagner's music.

The average human being finds no difficulty in carrying in his *mind* a certain musical theme or a complete score. It may be doubted, however, if this was possible of accomplishment by the Greeks or the Romans. It may be stated as certain that such a condition does not occur at any time in animals.

Animals may react to certain sounds, as, for instance, a dog may howl when a certain note is struck, but, as a rule, animals are entirely indifferent to written music as we understand the term, although certain animals may be trained to musical rhythm. It may be said here, however, that in this case there is no real understanding of music, and that the given animal would probably perform just as well with spoken words, or other noises given at certain intervals. This is well known to every animal trainer.

It is an erroneous conception that music primarily must be connected with sound received by the ear. It is quite possible for most individuals to *think* of a musical selection and go over the score *mentally*, without having recourse to any sound whatsoever. You may rehearse or memorize a certain song or selection, and you may derive as much pleasure from this mental music as if you actually were playing, singing or whistling the selection, or were listening to it played by an orchestra. Not only is it possible to imagine different musical selections, but the sounds of certain instruments can be rehearsed in the mind without much difficulty by the average individual.

Of course the stimulus will be greater if the music is actually heard, and perceived through the auditory nerves by way of the ear. On the other hand, those who have been born deaf, or have lost their hearing, need not necessarily be deprived of their musical satisfaction and enjoyment.

Deaf people—even those deaf from birth—have been trained to play beautifully the various instruments, particularly brass instruments, because the rhythm can be felt, due to the vibrations, set up by the instrument and the music can thus be enjoyed just as truly by such individuals as those who have perfect hearing. Possibly 50,000 years hence we may have graduated out of the present oral type of music entirely, and all music by that time will have become mental by impinging musical vibrations directly upon the human brain. Thus, for instance, in an instrument which I developed some years ago, and which I termed the *Physiophone*, it was possible for me to give the deaf some enjoyment, by letting them hold two brass electrodes. An attachment was made to a phonograph, which translated the sound vibrations of the phonograph into electrical impulses, which were felt as tingling shocks by the deaf person, who could thus perceive the music through his hands, although no sounds could be heard. A similar effect may be had by deaf persons when touching a musical instrument, such as the sounding board of a piano while it is being played.

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HOW LINDBERGH NAVI

The Action of the "Inductor"

By H. W.

Col. Charles Lindbergh, first air pilot to fly from New York to Paris, in a non-stop flight.

THERE has been a tremendous amount of interest shown by the public everywhere in the instruments used by Colonel Charles A. Lindbergh in navigating his famous Ryan airplane, the "Spirit of St. Louis," from New York to Paris. Where an aviator is flying over land he can, by the aid of good maps containing land marks on them, find his way without a great deal of trouble. When flying at night or in foggy weather the aviator's troubles of course multiply rapidly; but the greatest aerial journey which an air pilot can attempt is to fly across such a vast expanse of open water as that encountered by Colonel Lindbergh in his trip across the Atlantic Ocean, on that part of his journey extending from Newfoundland to the Irish coast, a distance of approximately 1900 miles.

INSTRUMENTS USED BY COLONEL LINDBERGH

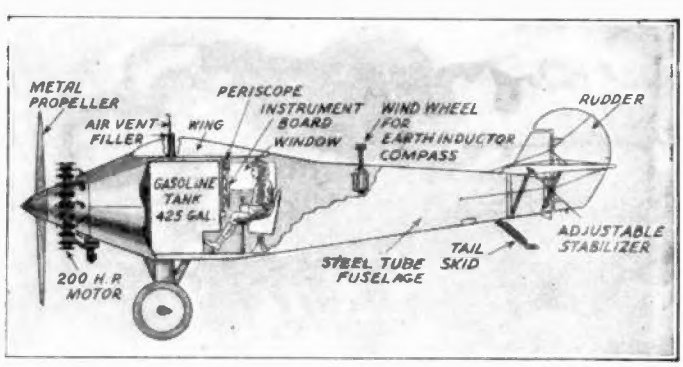
One of the accompanying photographs which was kindly supplied especially for this article by the Pioneer Instrument Company of Brooklyn, N. Y., who built the instruments and checked them just before Colonel Lindbergh started for Paris, shows practically all of the scientific apparatus carried by the intrepid airman.

Looking at the photograph of the instrument board, and beginning in the upper left hand corner, we find the first dial and needle to be that of an engine temperature gauge. This gauge indicated to Colonel Lindbergh the temperature within the oil-filled crank case of his famous Wright whirlwind motor at all times. This instrument comprised a pressure gauge of the flat tube type, properly connected to the indicating needle; and to this flattened expansible tube within the gauge there was joined a length of metal tubing which extended inside the crank case of the engine. This metal tube was filled with alcohol, and as the temperature in the engine rose or fell, these temperature variations were communicated to the alcohol filled tube and the variations in pressure thus produced in the alcohol-filled tube were transmitted and interpreted by the pressure gauge, which was calibrated in degree Centigrade. It is important to watch engine temperature.

The "Spirit of St. Louis" with Col. Lindbergh at right.

The second instrument from the left in the top row is the air-speed meter, calibrated in miles per hour. This instrument, while very useful to the air pilot, is quite simple in the way in which it works. The air-speed meter is also a pressure gauge, and it is connected with metal tubing or piping to a small air pressure tube, open at the end, known as a Pitot tube. This Pitot tube is mounted on the front of the wing at some distance from the fuselage. The faster the plane travels, the greater the pressure of air acting on the open end of the Pitot tube, and in consequence the greater the pressure of air in the tube connecting it to the air speed meter. Inside the meter is a metal diaphragm, connected with suitable gearing to the needle indicating the speed in miles per hour. In other words, it is a pressure gauge of fine design, carefully calibrated.

The inductor compass about which so much has appeared in the daily press, next engages our attention as we come to the third dial from the left, in the top row on the instrument board. This little instrument dial, bearing the letters L and R with a normal O-center position clearly indicated on the dial, together with the galvanometer needle at the center, is the main instrument that Colonel Lindbergh relied upon to keep him on his course. The pilot in steering a plane by the aid of the inductor compass keeps shifting his rudder from time to time, whenever the inductor compass needle swings to left or right (L or R). When the needle swings to one side or the other from the zero center, this shows that the plane is off its course. The pilot then proceeds to bring the craft back on its course, which has been set previously by the compass control dial seen at the lower center of the panel. In other words, the aviator steers his airplane so as to keep the inductor compass needle on the zero center, once his course has been set. The electrical principle upon which the inductor compass works, will be explained in detail a little further on.



Cross-section view of the "Spirit of St. Louis."

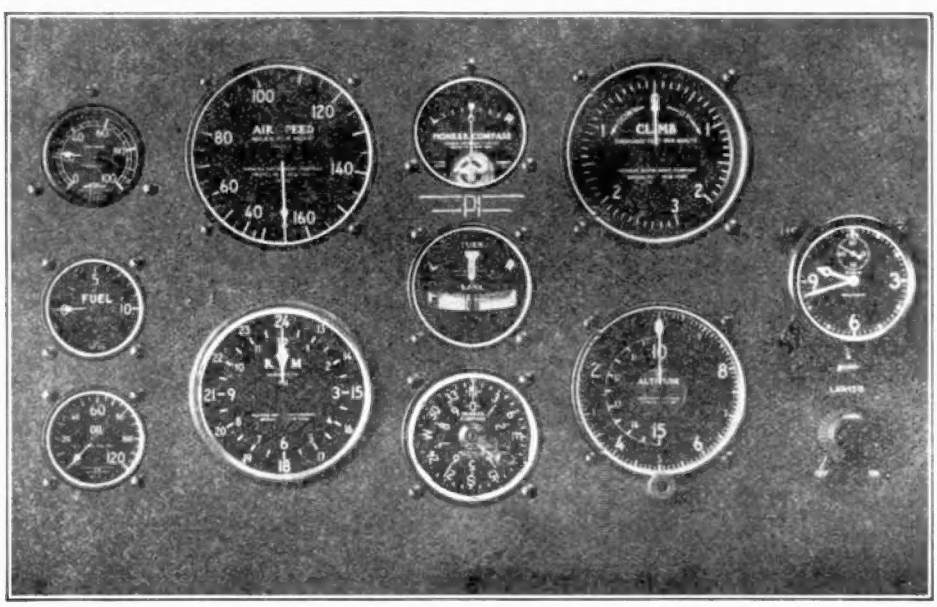


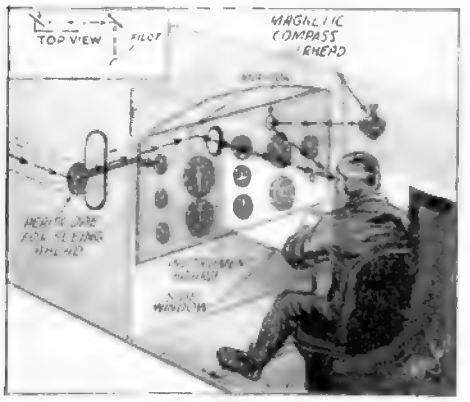
Photo above shows appearance of the instrument board fitted in the cock-pit of Col. Lindbergh's plane used in his non-stop flight from New York to Paris. The instruments are explained in the text.

The right-hand instrument in the top row is a rate-of-climb meter, and indicates directly to the pilot how fast he is climbing, or how fast he is descending, in thousands of feet per minute. This instrument is a differential pressure gauge, and as it works on the differential or difference between pressures it shows the rate of climb or descent.

Mr. Brice H. Goldsborough, of the Pioneer Instrument Company who checked the instrument board on Colonel Lindbergh's plane, the "Spirit of St. Louis," stated that contrary to the press reports on the finding of a jammed gasoline gauge by the French-

GATED ATLANTIC

Compass is Here Explained.
SECOR



Picture at right shows Col. Lindbergh in Paris with his wonderful airplane "The Spirit of St. Louis." Note French guards and picket fence to keep people from damaging plane. ⟶

At left may be seen arrangement of periscope as fitted in Col. Lindbergh's plane; it was used for looking ahead. The magnetic compass was read with a mirror, ⟵ as shown.

men at Le Bourget field, no gasoline gauge indicating the number of gallons of gasoline in the tank was carried in the plane used by Colonel Lindbergh. There was a fuel pressure gauge, which is the second instrument from the top on the left hand side of the panel. This showed the pressure in pounds under which the gasoline fuel was supplied to the engine. The instrument at the bottom of the left hand row is the engine oil pressure gauge similar to the one used on most automobiles.

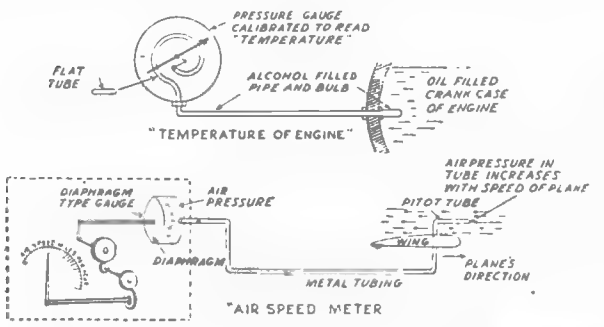
The large dial, second from the left in the lower row, is an engine speed indicator similar to a speed indicator or speedometer found on all automobiles today. It is a tachometer operating on the fly ball and gear-rack principle, the revolutions of the engine shaft being transmitted to it through a flexible shaft enclosed in the usual spiral casing. The dial is calibrated in r.p.m. or rather in hundreds of revolutions per minute.

The dial in the center of the panel bearing the titles L-turn-R and also the word *bank*, is a bank and turn indicator. This little instrument, which was devised by the engineers of the company already mentioned, and also partly by the experts of the famous Sperry gyroscope concern, involves the use of a specially devised gyroscope of the air driven type.

A compass, by itself, is of little value when flying in clouds or at night, as it is practically impossible for a pilot to hold his ship on a straight course, and a compass will only indicate correctly during straight flight or on very slow turns. By using a Turn Indicator, which shows the slightest divergence from straight flight, the pilot avoids turning, and his compass will function properly. A straight course is maintained by steering so as to keep the indicator in the central position. By keeping the ball in the center of its tube the aircraft is held laterally level when flying straight, or on the correct bank when turning.

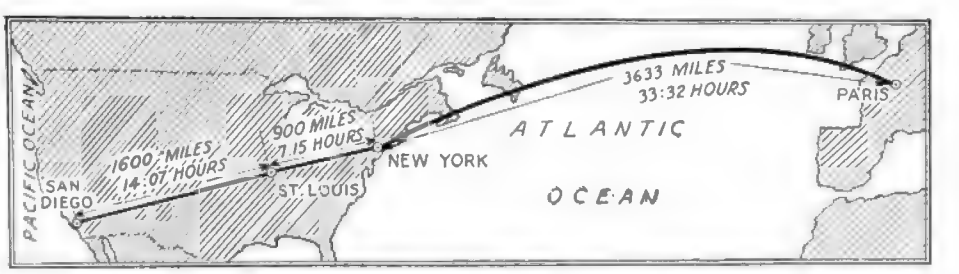
The sensitive element of the turn indicating mechanism is a small air-driven gyroscope, operated by the vacuum secured from a venturi tube. The gyro is mounted in such a way that it reacts only to motion about a vertical axis, being unaffected by rolling or pitching.

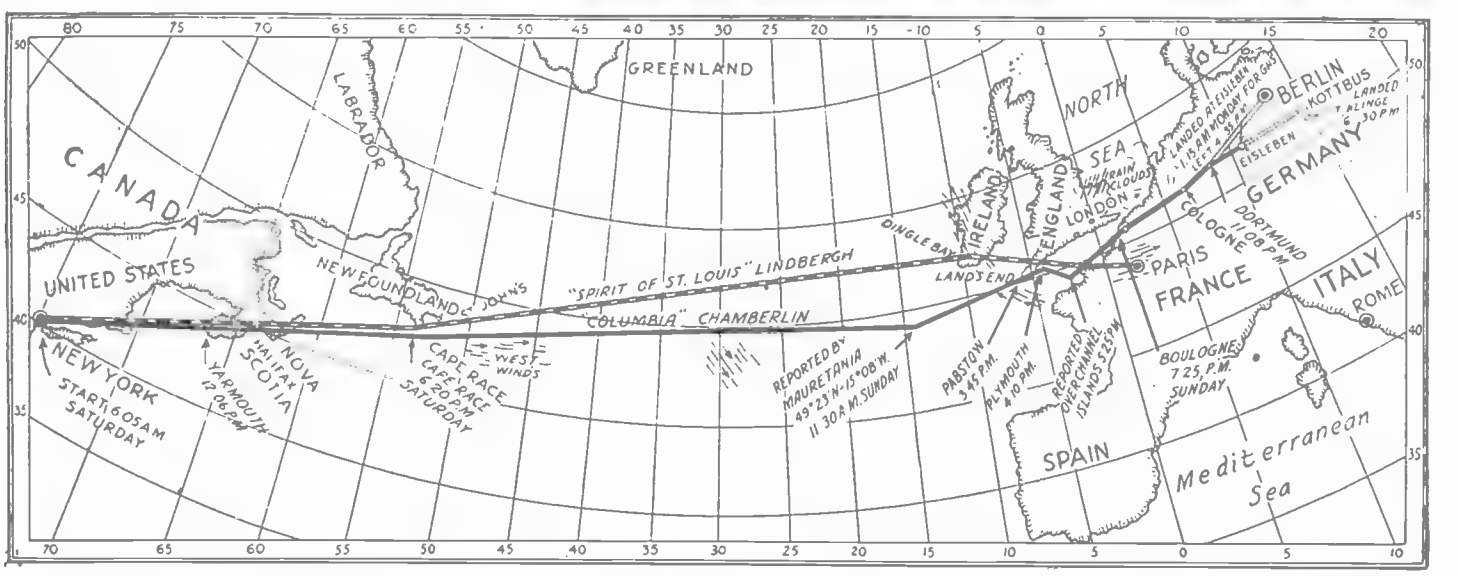
The venturi tube is a small horn shaped instrument fastened at some point external to the fuselage where the sweep of air impinges on it thoroughly, and the taper of the tube is so designed that as the air rushes through it, it causes a suction to be set up in a small tube placed within the larger one. The principle is similar to that met



The design of the gauge system used on Col. Lindbergh's plane for indicating the temperature of the engine is sbown in the upper diagram at left. A tube filled with alcohol was connected with a pressure gauge, calibrated to read in degrees of temperature. As the oil temperature increased, the alcohol pressure rose also, and the gauge showed an increase in temperature. The manner in which the "air speed meter" operates is shown in the lower diagram ⟵ at left.

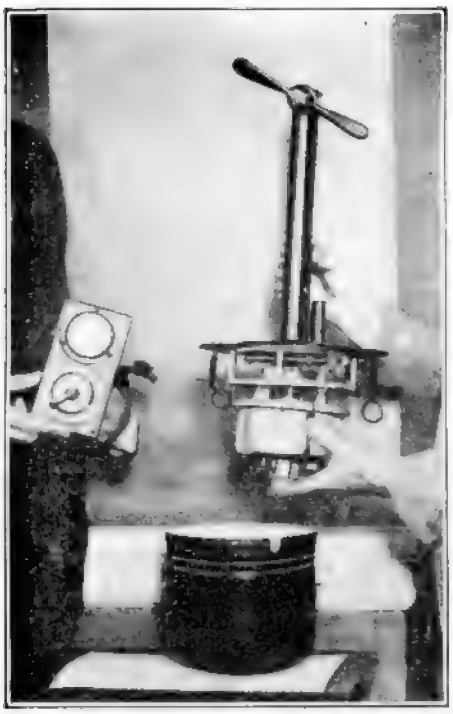
Col. Lindbergh's tremendous air jump from San Diego, Calif., to St. Louis, thence to New York, and across the Atlantic to Paris, is shown graphically in the map below. ▼





The map shows the route of Col. Lindbergh's famous airplane, "The Spirit of St. Louis," on its non-stop flight from New York to Paris. The longer and more southerly route taken by Chamberlin is also shown on this map.

Further details of Col. Lindbergh's navigation instruments



Above we see the famous inductor compass dynamo removed from its casing at the right; at the left is shown the "course setter" and indicating galvanometer.

with in the simple vacuum pump which one fastens to an ordinary spigot. In this spigot vacuum pump the water flowing rapidly through a large tube causes a vacuum to be set up in a small tube joining the larger one at an angle.

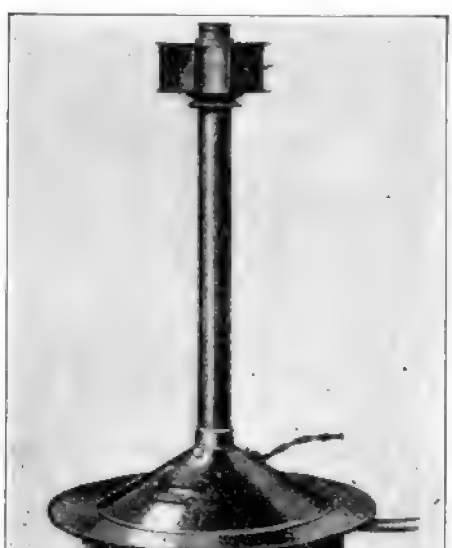
The dial and handle in the center of the bottom row of instruments is the *course setter* for the inductor compass. Here the pilot sets the dial for whatever direction he wishes to fly, say *east*. Suppose this dial is set at east or E; then the pilot keeps the plane on an easterly course by observing the galvanometer dial at the top of the center row, steering the plane so as to keep the galvanometer needle on the zero center mark.

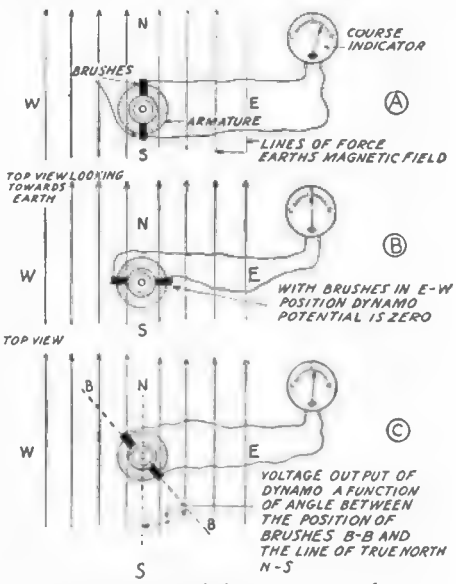
The large dial instrument at the lower right-hand corner of the instrument panel, is one of the most important devices carried by long distance aircraft and it is marked *altitude*. The dial is calibrated so as to read altitude or height above sea level in thousands of feet. As may be surmised it is a particularly well built and accurately calibrated aneroid barometer. The altitude gauge or altimeter is very important on all long distance air trips, particularly so when flying in a fog or at night. If it were not for the altitude gauge, the pilot would find it difficult to tell how far he was above the land or ocean on a stormy night or in a fog, as becomes evident.

The instrument seen on the extreme right of the panel is an eight day clock with a radium luminous dial, and directly below it is a switch to turn the cock-pit and instrument board lights on and off.

Colonel Lindbergh carried no navigating instrument such as a sextant, as he had no facilities or time to use them, and he relied particularly on his inductor compass to lead him to the Irish coast and thence on to Paris. Colonel Lindbergh also had a magnetic compass which was mounted just above his head, the reversed dial of which he read in a mirror placed on the instrument board, as one of the accompanying illustrations shows.

In the particular design of the entirely closed cabin or cock-pit in which Colonel Lindbergh sat on his 3600 mile journey from New York to Paris, he could see very well out either side through glass windows, but he could not see directly ahead or behind. To see ahead he used a periscope comprising two mirrors, as indicated in one of the illustrations herewith. Whenever he wished to use the periscope for looking ahead, he simply moved a lever which projected a mirror on the end of a stick out through a hole on the fuselage, as the illustration shows. The image picked up on this mirror set at an angle, was reflected onto a second mirror set at a corresponding angle, behind a hole in the instrument panel. One of the mirrors became broken just before the Colonel started for Paris, and when one of the engineers checking up on the instruments, asked if one of the ladies present would like to donate a mirror for the Trans-Atlantic plane, a riot was nearly precipitated.





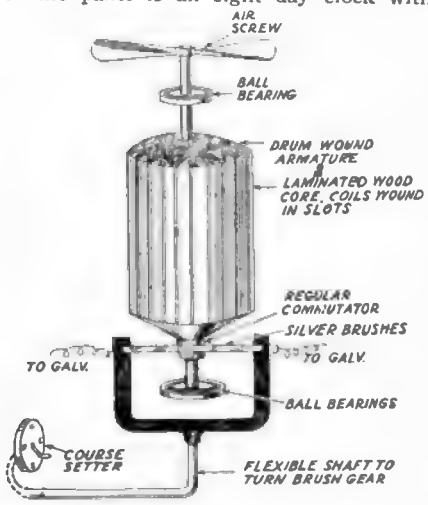
The brushes of the inductor compass dynamo are rotated from cock-pit panel, to the point where the galvanometer needle will indicate zero or center position, when the plane is being flown along the course corresponding to the setting of the dynamo brushes. If the plane gets off its true course, the galvanometer needle will swing either to the right or left, and the pilot then shifts his controls so as to bring the plane back on the sourse, as is indicated when the galvanometer needle again points to zero center on the scale.

There is regularly built a drift indicator or gauge and also the drift is checked up in some cases by dropping smoke bombs on the water. Colonel Lindbergh carried these smoke bombs but did not use them he stated, he having calculated his drift from his true course by observing the white caps and his relative motion to them.

HOW THE INDUCTOR COMPASS WORKS

Most everyone is familiar with the ordinary magnetic compass which indicates true north by virtue of the magnetic attraction of the north magnetic pole of the earth for the oppositely magnetized end of a pivoted steel needle. The magnetic compass of the familiar type, is liable to a number of errors, and aviators in general do not place too much reliance on it. In the past few years, the inductor compass which

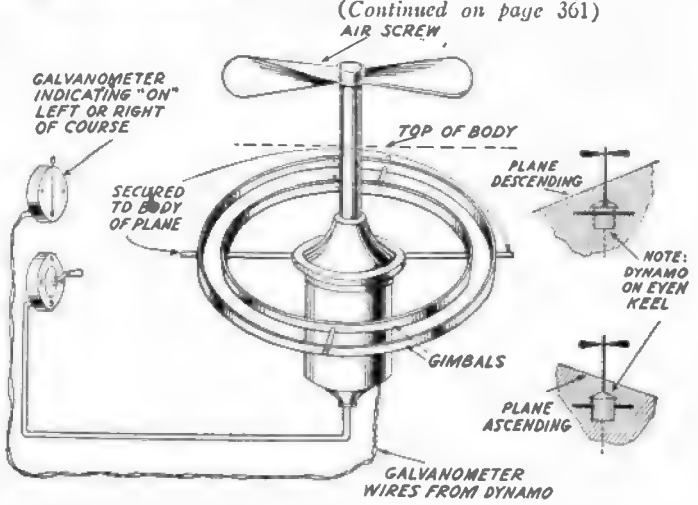
(*Continued on page* 361)



The photo above shows inductor compass dynamo in its weather-proof casing, with armature shaft extending up through the top of the casing, and to the top of this shaft is secured a propeller, so that the wind may spin the dynamo.

Illustration at left shows how wood core armature of inductor compass dynamo is wound, and also how the silver brushes are mounted on a movable frame controlled from the instrument panel.

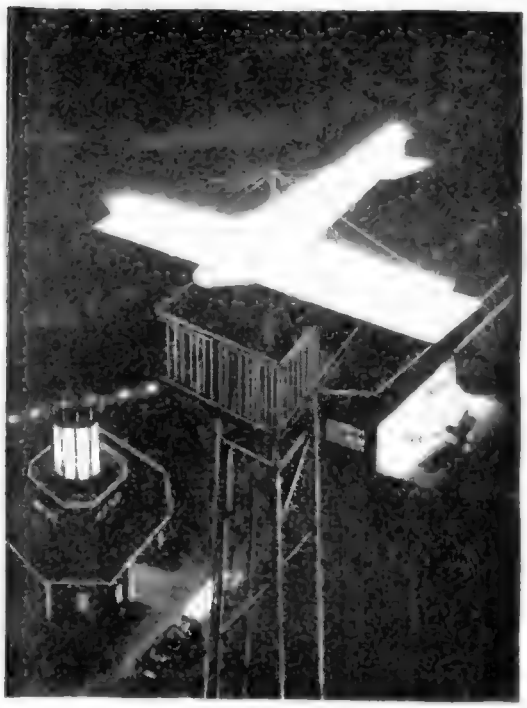
Diagram at right shows how inductor compass dynamo is swung in gimbals so as to always preserve a vertical plane with respect to the earth, no matter whether the airplane is ascending or descending.



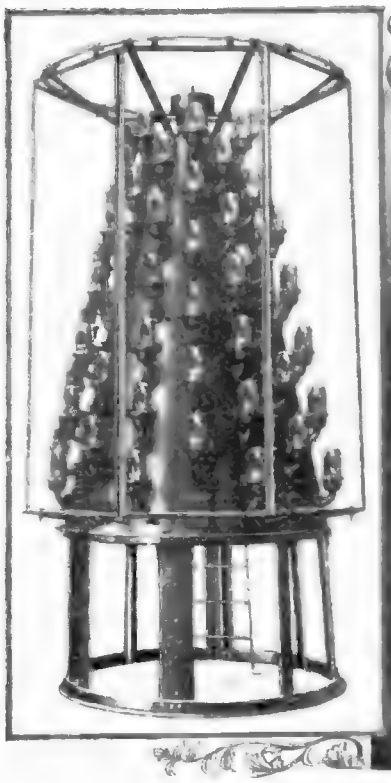
Berlin Landing Field at Night

By DR. ALBERT NEUBERGER

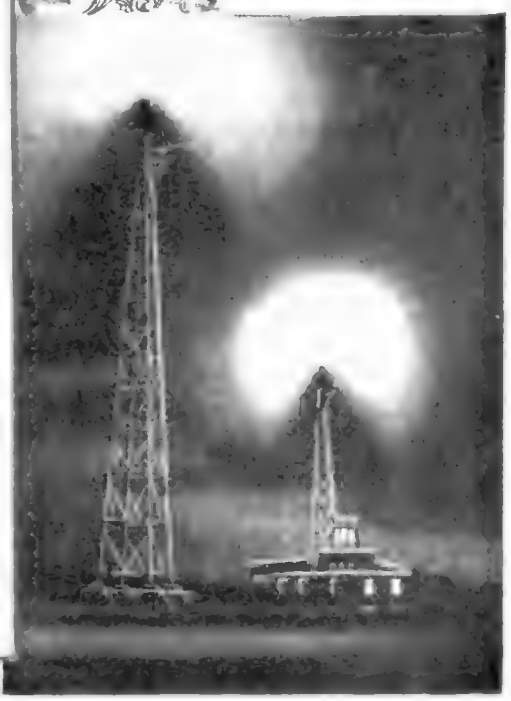
Below is a photograph of a Pintsch airplane weather vane.



In the center picture may be seen the Pintsch multiple lamp lighthouse.

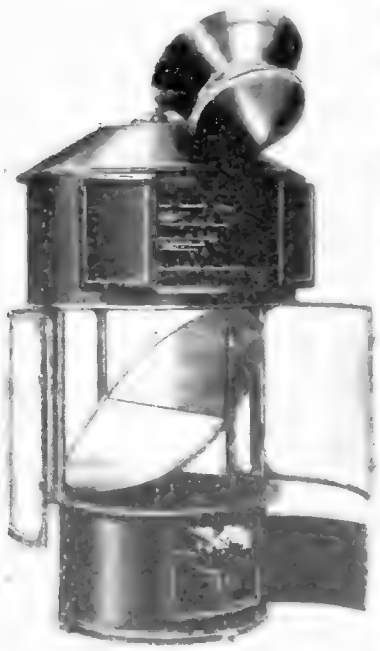


The Pintsch neon lighting system on the Berlin Tempelhofer Field may be seen below.

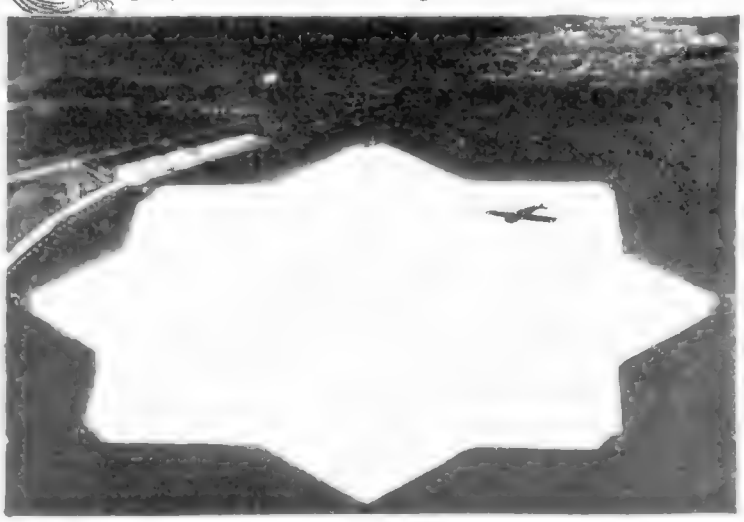


MANY years have passed since the signaling systems of our railroads were devised and developed. Decade after decade constantly saw one improvement follow on top of another until they have given us an almost complete safety. The same safety must be obtained for air travel. Although the number of flying routes is proportionally very slight, many flying machines now reach their destiny in the evening or in the night. To facilitate flying at night inventors have developed a number of remarkable structures, among which and before all others is the aerial lighthouse of Mont Valerien in Paris. Here we see the strongest source of light upon the earth. The rays from this huge lamp are brought into parallelism by the use of a perfect parabolic mirror or reflector. The light of this focus for aerial travel is sent out in the form of a beam and can be seen at a distance of nearly 250 miles. The towers with their two projectors sending out beams in opposite directions may be seen on this page. These lights are carried on a revolving platform so that the beam disappears for a certain length of time and then reappears. This airplane travel lighthouse makes the use of various directing lights within the range of its beam unnecessary, and it belongs to the class of the so-called pilot lights, while the course lights are of lower power. For these course lights, which have to be distinguished so as to avoid confusion with other lights upon the surface of the earth, and so as to be recognized without mistake, various constructions have been invented.

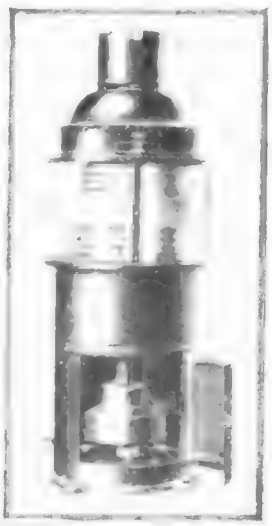
Experience has shown that the visual range of a light increases with the size of the incandescent surface. This solution has been found in the use of multiple lamps, one of which appears on this page. The lamps are arranged in the shape of a truncated cone. Over the surface of such a cone 96 lamps are distributed. A light of this nature can be seen at a distance of 35 to 50 miles. The illumination of the landing field carried out by the Dutch at Waalaaven is a model for other landing places. Eight lights are placed around the field and optical arrangements are so carried out that every lamp sends out a beam that spreads over an angle of 90 degrees and is directed downward.



Pintsch's lighthouse with the rotating mirror may be seen in the photograph above. Note the construction and size of the reflector.



Here we have a view of the Waalaaven illuminated landing field. By using this method the broad field becomes as light as day and the airplanes have little difficulty in landing even in spite of adverse wind conditions. This mode of lighting has done much to eliminate accidents.



The Pintsch direction searchlight for guiding planes at night is shown above.

What Chance Has Your Baby?

The Relative Life Chances of Boy and Girl Babies at Various Ages

By H. H. DUNN

This seven-months-old baby girl has one and one-quarter chances to live compared with one chance for a boy of the same age, provided both are given the same environment and care. Her sex gives her the better chance for life.

WHAT CHANCE has your boy baby to live?

Less than your girl baby by about 28 per cent.

This is the answer of Dr. Samuel J. Holmes, Ph.D. professor of zoology at the University of California, who has made a tabulated study of the deaths of 3,405,464 babies, who died between 1900 and 1923, in all parts of the United States. Every state furnished its quota of these deaths, and the information concerning them was taken from hospital, municipal, county and state records, so that it is official and accurate.

Out of this study, the most comprehensive ever made on the subject, Dr. Holmes deduces two important conclusions:

First, that the male is inherently the weaker sex.

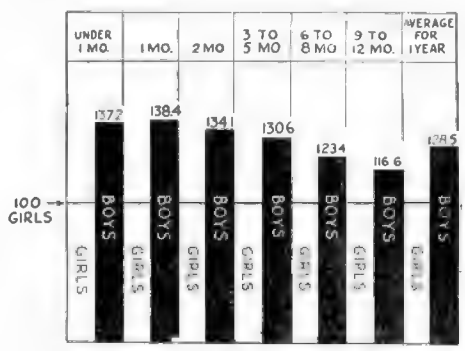
Second, that man's inferiority in this regard is a matter of heredity.

Up to and under one month, 137.2 boy babies die for every 100 girl babies. At one month, the ratio increases to 138.4 to every 100 females, but then, the boys' chances of life improve. At two months, 134.1 boy babies succumb, as compared with 100 girls. In the three to five months period, the ratio drops to 130.6; from six to eight months, 123.4 boys die to every 100 girls, while from nine to twelve months, the relation is 116.6 males to 100 females.

Under and up to one year, the average mortality of babies in the United States is 128.5 boys to every 100 girls. Thus, your boy of one year or less has one chance to live as compared with somewhat more than one and one-quarter chances possessed by his sister of approximately the same age. In figures tabulated from 1914, when white and negro vital statistics were separated, to 1923, it appears that the differences in the death rates of the two sexes were somewhat less for colored infants. For every 100 white girl babies who died in that period, 131.5 white male infants passed out, though for every female pickaninny, only 1.22 negro boy babies died.

In England and Wales, from 1901 to 1919, the ratio of boy baby deaths under one year to girl baby deaths at the same ages, was 128.8 to 100, slightly higher than in the United States for the same period.

Dr. Holmes' tabulations show that in places and in periods where infant mortality is high, the ratio of boy deaths to girl deaths is low; and, conversely, where there is a low rate of infant mortality, the death rate of boys is relatively high. With the reduction of infant mortality which has been made in recent years in the United States, there has been a marked *relative increase* in boy deaths. The sex-ratio at death—or the ratio of boy deaths to girl deaths—varies with the age of infants in the first year of life. For young infants, it is high, but it decreases during the year.



Above is graphically shown the difference in infant mortality between girl babies and boy babies. The figures are the number of male babies dying as compared with 100 girl babies passing away.

"Following the course of sex mortality after the first year," said Dr. Holmes to the

(*Continued on page 375*)

This yearling boy has one chance to live compared with 1.16 chances of a girl one year old. All boy babies, however, are handicapped by the very fact of their maleness.

Study of this table shows a number of interesting coincidences of virtually the same ratios from different diseases at widely verying ages. These coincidences are being made the objects of further study by Dr. Holmes and his staff. ⟶

DEATH RATIO OF INFANTS

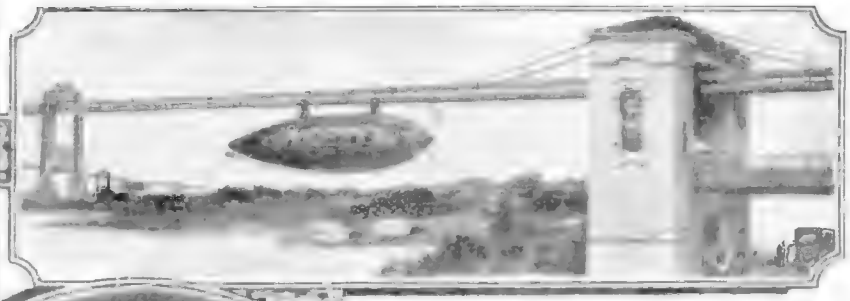
Cause of Death	*Under 1 month*	*1 month*	*2 months*	*3-5 mos.*	*6-8 mos.*	*9-12 mos.*
All causes	137.2	138.4	134.1	130.6	123.4	116.6
Whooping cough	87.7	90.9	99.8	104.1	84.9	83.3
Influenza	144.2	158.8	135.7	135.8	133.0	129.3
Tuberculous meningitis	95.1	161.1	111.2	132.1	120.5	107.4
Respiratory tuberculosis	145.5	167.5	128.2	122.0	124.6	102.3
Other forms of tuberculosis	120.0	140.6	152.0	142.9	163.6	120.5
Syphilis	130.0	133.1	137.1	130.4	117.8	120.1
Diarrhea and enteritis	138.6	143.5	136.1	134.9	121.1	119.9
Stomach diseases	143.3	166.3	128.7	136.4	124.8	109.4
Bronchitis	128.2	128.1	130.2	129.3	120.1	105.8
Pneumonia	135.1	146.8	139.0	143.1	135.7	121.8
Broncho-pneumonia	140.1	142.5	135.6	138.9	127.8	115.4
Malformations	133.3	136.7	135.6	120.9	108.1	117.0
Prematurity	133.4	109.5	104.6	96.4	125.2	103.7
Congenital debility	138.7	146.9	138.6	126.4	118.8	115.4
Injuries at birth	161.3	128.2	142.0			

Sex ratios for deaths of infants in subdivisions of the first year in the United States, based on figures for the years 1916 to 1923, inclusive, are shown in the table in which the figures are the number of male babies dying as compared with 100 girl babies passing away.

THE MONTH'S SCIENTIFIC NEWS ILLUSTRATED

By George Wall

Two double-headed electric fire and wrecking trucks will safeguard the lives of the motorists who travel through the new Holland tubes which connect New York and New Jersey. The trucks have driver's seats, steering apparatus and cranes, so that they can be driven in either direction without the necessity of turning. These special trucks will be at the scene of an accident within a moment's notice and thus do much toward preventing traffic blocks.

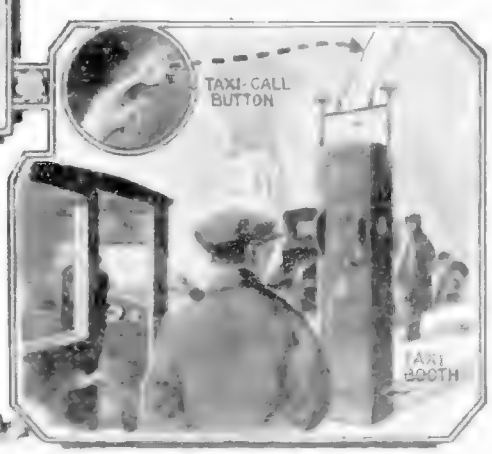


A German inventor, Franz Kruckenberg, has completed the plans for a suspension railroad. The cars, which are driven by a propeller, will attain a speed of more than two hundred miles an hour. Although no definite steps have been taken for the construction of this road, the efficiency of the present suspension system now operating in the Ruhr district favors the plan. The inventor has patented his idea in the United States and abroad.

Not content with the usual precautions against burglars, the bank of England is making provision for emergencies when, for some reason, the bank staff might be unable to lock the underground treasure vaults. The vaults will be so constructed that they can be flooded by the pressure of a button at any one of three points. These buttons, are to be located, one within the bank, one elsewhere in London and one in the country ten miles outside of London.

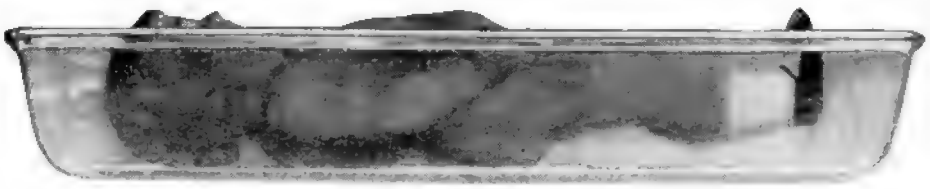
A recent Swedish invention provides for the reception of telephone messages in the absence of the householder and for their reproduction upon his return. It is attached to an ordinary telephone and directly connects the device with the central operator.

A long range searchlight gun, which flashes pictures or images upon clouds, buildings or smoke screens, has been perfected by the General Electric Company. Projectors with a 60-inch searchlight will throw a clear image as far as five miles. The sky writer which has been perfected uses an eighteen-inch searchlight and can be operated with an incandescent bulb or carbon arc. The installation of these new projectors will probably open a new field for advertising. By installing these projectors in the suburbs of large cities it will be possible to show any number of advertisements at the same time, without having to construct the costly frames and supports now needed for luminous signs.



Vienna is now using the new "taxiphone" which is illustrated above. These booths, placed at intervals along the streets, are connected by wire to theatres, apartment houses and the like, from which, by pressing a button a call for a taxi can be sent to the nearest booth. If there is no taxi waiting the call is sent to the next nearest stand.

It is suggested that if the Sherry-Netherland Hotel had been equipped with a wholly inclosed elevator, suitable to carry a 40-gallon chemical fire extinguisher, the fire undoubtedly could have been easily extinguished in its early stages. The extinguisher would be equipped with wheels, so that it could be moved easily in different directions, thus making it possible to reach all portions of the blaze. By installing totally inclosed elevators in all of our large buildings, it would be possible at all times and under all conditions to reach fires in the towers. At present, although our buildings are fire-proof, the smoke and fumes sometimes prevent the fire-fighters from reaching points of vantage in time to prevent serious damage. Another idea is that such enclosed elevators are always desirable for carrying passengers to the ground floor.



Here is a photograph of a doll weighted so that it will float in water to the same depth as a human being would float in the same medium. Compare with photo at right.

The Impossible

NO. 1 OF

By HUGO

Member American

IF you contemplate the front cover of this month's issue of SCIENCE AND INVENTION, you will be struck by what appears to be "an impossibility."

If you know anything about swimming at all, you will know that it would be quite impossible for the young lady to float on the water as depicted in our cover illustration.

Furthermore, the ball which looks like the usual large medicine ball used so much at our sea resorts, could not possibly float in water as shown in the illustration. If the young lady were placed in water, as she appears to be, she certainly would, if at rest, sink so that practically her entire body would be submerged. Not all people, it may be said, float the same way. A thin and emaciated person will practically sink so that only the nose stays above the water. The reason is that the human body has about the same specific gravity as water, and would sink at once to the bottom of fresh water if the body did not contain a certain amount of air, principally in the lungs, and to a lesser degree in some of the other organs throughout the body.

Certain parts of the body are heavier than water, such as for instance, the skull and the bone structure. This, however, is counterbalanced by the fatty tissues which weigh less than water. Thus, a fat man or woman can float more readily in water and the body will rise out for a greater degree over the level of still water, than that of thin persons. So delicate is the balance, that a person will sink to the bottom if his lungs become filled with water, which is sufficient to make the body go to the bottom. If it were not for decomposition setting in, which gives rise to gases, the body would never come to the surface again. It is these gases principally which are responsible for a dead person coming to the surface again.

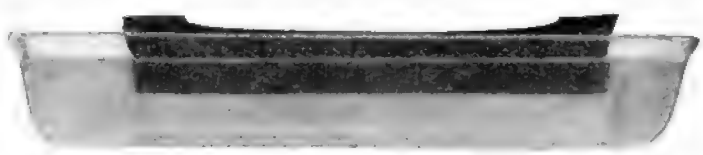
What has been said here, about the human body floating, holds good only for ordinary fresh water. In sea water, which latter has a higher specific gravity, the human body does not sink as deep. For instance, the water of the Dead Sea has a high specific gravity while that of the Great Salt Lake near Salt Lake City has a specific gravity of 1.66, which means in other words, that this salt water weighs about 60% more than fresh water, the specific gravity of which latter is 1.000.

Inasmuch as the specific gravity of the human body is about the same as that of clear water, it will be seen that it is impossible for a person to sink in either the Salt Lake, or in the Dead Sea, because even though the person be emaciated, over 60% of his body will rise above the water. From this we can form an idea of just what will happen if you submerge a human body in liquids that are denser, or in other words, as the scientists term it of a, "higher specific gravity" than ordinary water.

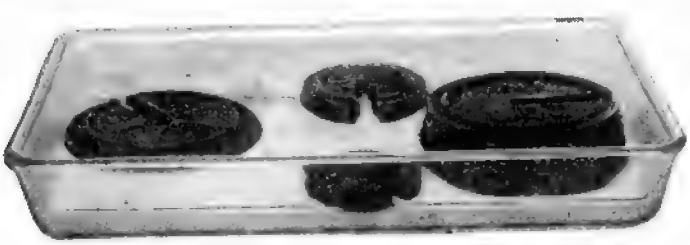
If you submerge a human being into a liquid which has less weight than water, such as, for instance, oil—which floats on water and is therefore lighter,—even the fattest person will sink rapidly if thrown into a tank thereof. Any human being thrown into lighter liquids would have a great deal of trouble to keep afloat, and would have to expend more energy to keep above the surface.

One of the lightest liquids in existence, namely methenyl diphenylamine, would make it quite uncomfortable for the person who ventured into a tank filled with such a liquid. Even with the most strenuous exertion it would be impossible for the swimmer to keep his face above this liquid, which has a specific gravity of only 0.558, or about half that of water.

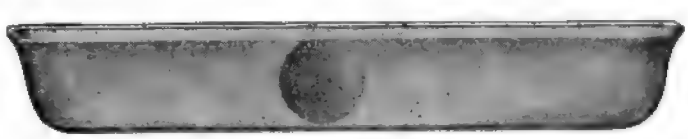
Furthermore, it is a well-known physical principle that a floating body sinks and keeps on sinking until it displaces its own weight in the liquid in which it floats. You will remember, the well known anecdote, about Archimedes and his famous bath; when he found that his body displaced enough water to make his bath tub overflow, he ran out into the street, oblivious to the fact that he wore no clothes at all, shouting "Eureka" (I have found it.) What he found was the law of specific gravity mentioned above, that is, a floating body displaces the same weight of water that is equal to its volume.



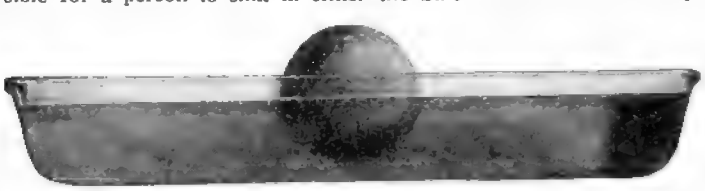
A photograph of a toy boat floating in water. Compare this photo with photo on opposite page.



The iron weights used in our experiments which are ordinary platform scale weights, are here seen floating in mercury. The weight at the right is double and consists of a two and a one pound iron disk.



An ordinary golf ball sinks in water and comes to rest at the bottom of the vessel. Many golf enthusiasts know this.



In water, a tennis ball sinks to one-half its height as indicated in the photograph here.

Going back to the Salt Lake experiment where we noted that it is impossible for a human body to sink, we can now imagine liquids still heavier, where the body will submerge even less.

This is the idea behind the cover of this issue of SCIENCE AND INVENTION.

What then is the answer? *Mercury*, popularly called Quicksilver.

Mercury is the only metal that is liquid, and the reasons why this should be so are still only understood rather vaguely by our scientists. Mercury by no means is the heaviest element, although it is popularly thought so. The specific gravity of this metal is 13.595 at 4° Centigrade.

There are, however, some metals heavier than mercury. They have a specific gravity as follows: Gold—19.32 at 17.5° C.; Iridium—22.42 at 17° C.; Osmium—22.48 at Atmospheric temperature; Platinum—22.35 A; Tantalum — 16.6A; Tungsten — 18.7A; Uranium—18.68A.

Let us now imagine a lake of mercury. Here the appearance of a human body floating will be exactly as that shown on our cover illustration. The lake of mercury, which looks like calm water, is supposed to be about 22 inches deep, with the young lady resting exactly as pictured. Only one-thirteenth of the human body can be submerged while floating in mercury, while twelve-thirteenths is out of the mercury. In other words, only an exceedingly small portion of the body can be submerged while at rest, when floating on a lake of mercury.

The young man shown in the illustration would find some difficulty to stand in 22 inches of mercury, as he would have trouble to maintain his balance. The tremendous specific gravity of mercury as compared with that of the human being, tends to push everything lighter in an upward direction. Therefore the young man as pictured would only stand in this position a second or less after which he would fall over, and splash on top of the mercuric pool.

The heavy medicine ball which in water would be practically submerged, would float exactly as shown, only 1 or 2 inches being submerged below the surface of the liquid.

To show what effect mercury has on various different everyday articles, we performed a number of experiments in SCIENCE AND INVENTION Laboratories, and the photographs reproduced herewith show some of the results.

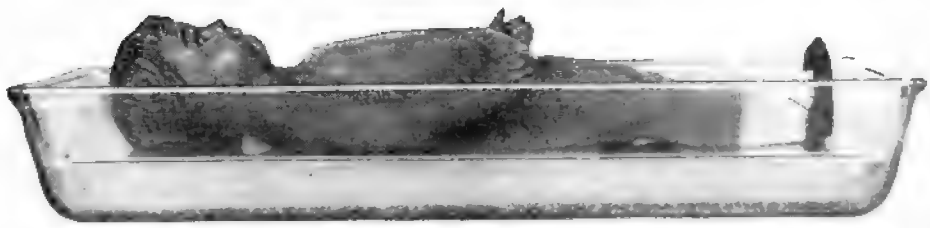
We first took a celluloid doll, and loaded it with buckshot, in such a way that when floating in water it would duplicate exactly the condition found if a human being were floating. This condition is shown in the illustration where the doll floats exactly as would a human being in water. Then the same doll weighing exactly the same amount,

Is Possible

A SERIES

GERNSBACK

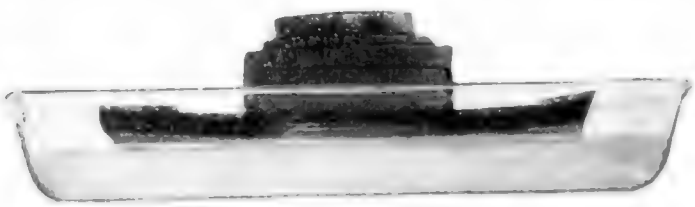
Physical Society



This is the same doll as in the photograph on the opposite page. It is here floating in mercury. Note that daylight can be observed beneath the neck and knee.

was placed upon mercury with the result as shown.

We might state that we would have liked to make the experiment with a full grown human being, by using a bath tub full of mercury, but unfortunately, this would have taken nearly 31 tons of mercury, which at the present value of mercury, $2.00 a pound, would represent $121,632!! We thought we had better not attempt this experiment, because in the first place, we probably would not have been able to find that much mercury even in New York City, and secondly, if we had poured the mercury into a standard cast iron bath tub, it might even have burst into pieces, sending the quicksilver in all directions due to tremendous weight of this liquid.



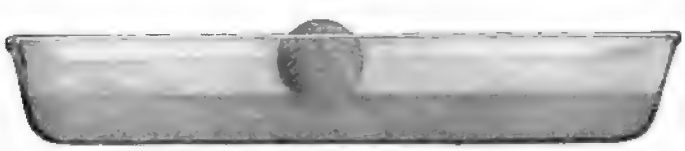
The wooden boat made to sink in mercury to a depth identical with the same vessel in water required an additional weight of 3½ pounds.

In some of our illustrations, we have shown how even iron weights float easily on top of mercury.

A toy boat is also shown floating in water, and in order to make it sink to the same depth in mercury, it was necessary to place iron weights on it weighing 3½ pounds. This, not withstanding the fact that the little boat only measured 9¼ inches long, 2¼ inches wide and one inch deep.

A most interesting photograph shows a heavy solid glass inkstand floating on top of the mercury, as well as a small "B" battery. Although heavy and solid you can see how nicely both float, just as a cork would float on water. A pair of pliers is seen floating between the "B" battery and the glass ink well.

A surprising photograph is the one that shows the golf ball, which, of course, sinks to the bottom in water, and even sinks much further in the mercury than one would at first suspect. For instance, a tennis ball in water sinks almost all the way down, in mercury it practically does not submerge at all. The reason here, of course, is that the specific gravity of the golf ball is quite high. In other words, it is rather heavy, and that is the reason why it sinks a little further in the mercury than does the tennis ball.



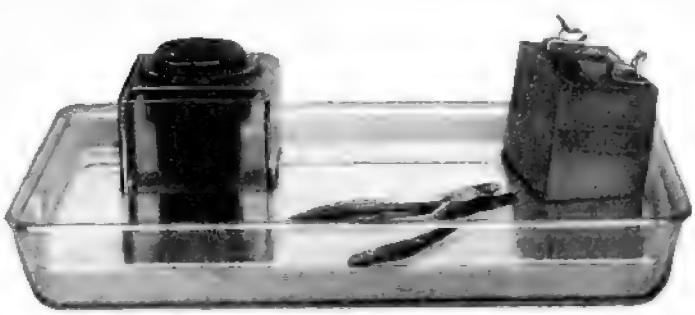
How golf enthusiasts would appreciate a lake of mercury instead of water. Observe how the ball floats.

An interesting problem comes up here, which has not been solved entirely. In South America there is a small lizard which can actually run over a solid sheet of water without sinking into it. Now, the little lizard weighs more than the water, consequently he should sink through the surface of the water and go below it. The point, however, is that he runs so fast and his motion along the water is so rapid that he does not sink in at all. By beating the surface of the water rapidly enough he can thus run on top. This can be likened to the skipping stone, with which we are all familiar. Of course, surface tension has something to do with the phenomenon. A problem now comes up: Suppose we had our imaginary lake of mercury. How fast would an average man have to run without sinking into the mercury? And is it possible for a man to run on the surface at all? Theoretically, of course, it is possible, if he runs fast enough. From a practical standpoint it is hardly possible for a human being to run fast enough, without sinking into the surface of the mercury. Then, too, if he sank into the mercury at all, his motion would necessarily be retarded, because the mercury itself, in closing in over the foot, would very likely retard his motion.

On the other hand, referring back to the lizard, the surface of the lizard's feet, as compared to the rest of his body, is quite large. This is not true of the human foot, where the surface is rather small. Furthermore, if the human being had four feet he would not have to run as fast on the surface of the mercury as with the two he has. Moreover it is questionable whether he could do the trick at all, due to his high center of gravity, which would tend to upset him, while the lizard's center of gravity is not much higher than the feet, and consequently he has no trouble maintaining his equilibrium. You might say, therefore, that for practical purposes it would be impossible for a man to run along the surface of liquid mercury, even if he could run fast enough.

It is interesting to conjecture at this point as to just how difficult it would be to remain afloat in liquids as light as ether or even gasoline. The questions naturally arising are: Can our best swimmers remain afloat in either of these two liquids? Can any of the present swimming animals remain on the surface in these liquids? The feat would seem quite impossible in liquids having a specific gravity of approximately one-half that of water, one of which was mentioned in a previous paragraph of this article, unless the swimmer himself very vigorously moved his hands and feet, thus keeping his head above the surface of the liquid.

One might even attempt to calculate the speed of swimming in a body such as mercury, the friction of which is slight but the buoyancy of which is very pronounced. Would the hands of the swimmer slip through the mercury more so than they do in water; or would the swimmer be capable of phenomenal speeds; are interesting questions to cogitate upon.

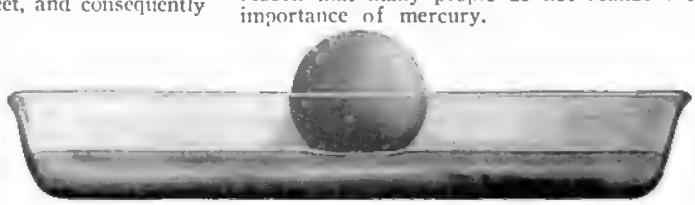


A glass ink well full of ink, a pair of cutting pliers and a "B" battery float in mercury. Observe how the "B" battery tips at an angle. Its construction makes it heavier on one side than on the other.

Another very interesting problem is the reason why the B battery tips over at an angle in the mercury. These batteries, as we all know, are made quite expertly, and the weight of each individual cell should practically correspond to that of the adjacent cells. What then makes the battery tip? Does this illustration not prove that objects floating on mercury are not necessarily level?

What does all this prove?

In the first place, never trust your senses too much. What appears impossible at a glance, may not be so impossible after all. At the same time, we have gone to this length to show these experiments, because there is no telling that someone will not put the experiments to some practical use in some way of which we do not even dream. Mercury is used a great deal in the arts as well as in the industries, and we believe there are many other additional uses which are not in common practice, simply for the reason that many people do not realize the importance of mercury.

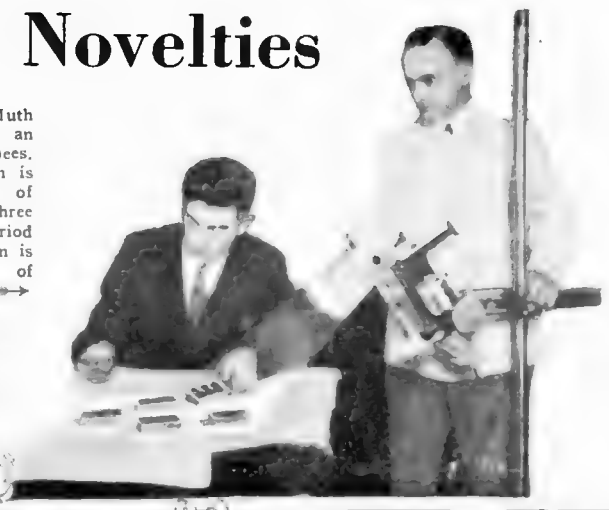


A tennis ball seemingly rests upon the very surface of the heavy, silvery, metallic fluid.

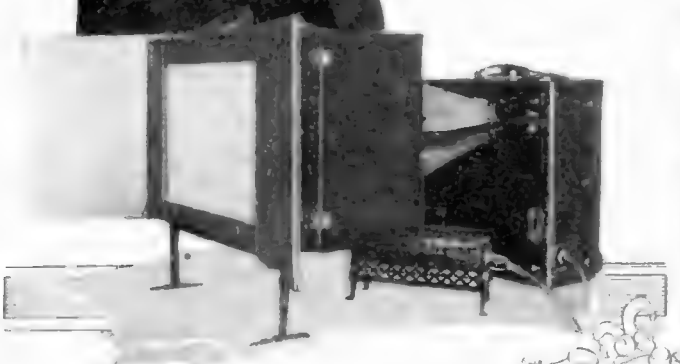
Mercury supplied through the courtesy of Chas. Cooper and Son, New York City.

Scientific Novelties

Dr. George D. Meeker and Clifford Muth are shown at the right administering an ultra-violet ray treatment to queen bees. The egg laying capacity of the queen is greatly increased by the application of ultra-violet rays of light for about three minutes each day, extending over a period of days. A similar line of investigation is being undertaken at the University of Cincinnati. ⟹



Professor Dayton C. Miller is shown at the left holding a glass flute which gives nearly perfect notes. Professor Miller found that the tone quality of the flute improved with the increase in density of material, and that a solid gold flute has a wonderful rich tone which can not be achieved by any other instrument. Platinum, which is denser than gold, will make a still more admirable flute. The gold flute is the only one of its kind in existence. ⟸



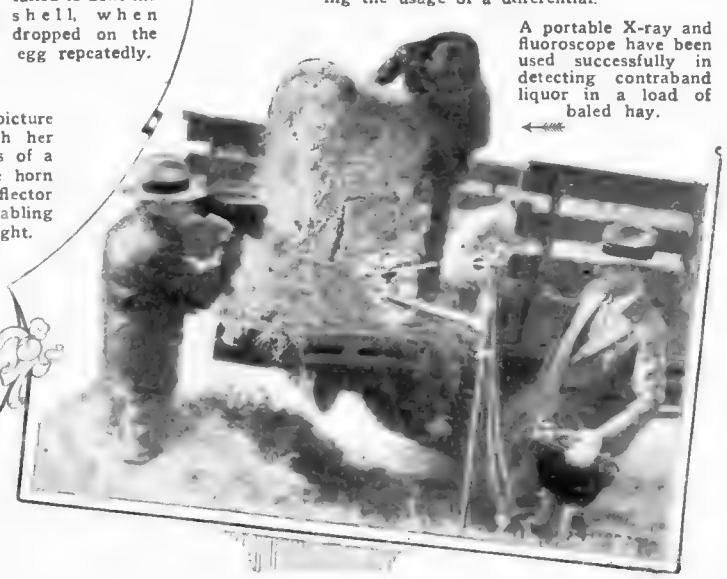
The compact movie projector, shown above, has been perfected in Germany and is rapidly becoming popular in European homes. The device is small in size and can be operated from an ordinary electric light socket.

Tests were recently made on a new airplane stabilizing device, designed by Robert Mitton. In a plane equipped with this mechanism, a pilot flew for forty-five minutes with his hands outstretched. The stabilizer is shown in the photo at the left. ⟸

The strength of an egg shell was recently tested at Cornell University. A 16-pound hammer failed to dent the shell, when dropped on the egg repeatedly.

The small children's automobile shown above has been perfected in England. It is driven by an electric motor geared to one wheel, thus eliminating the usage of a differential.

Claire Windsor, motion picture actress, is shown below with her new invention, which consists of a small mirror mounted on the horn button with a light and a reflector placed in back of it, thus enabling the user to "make up" at night.



A portable X-ray and fluoroscope have been used successfully in detecting contraband liquor in a load of baled hay. ⟸

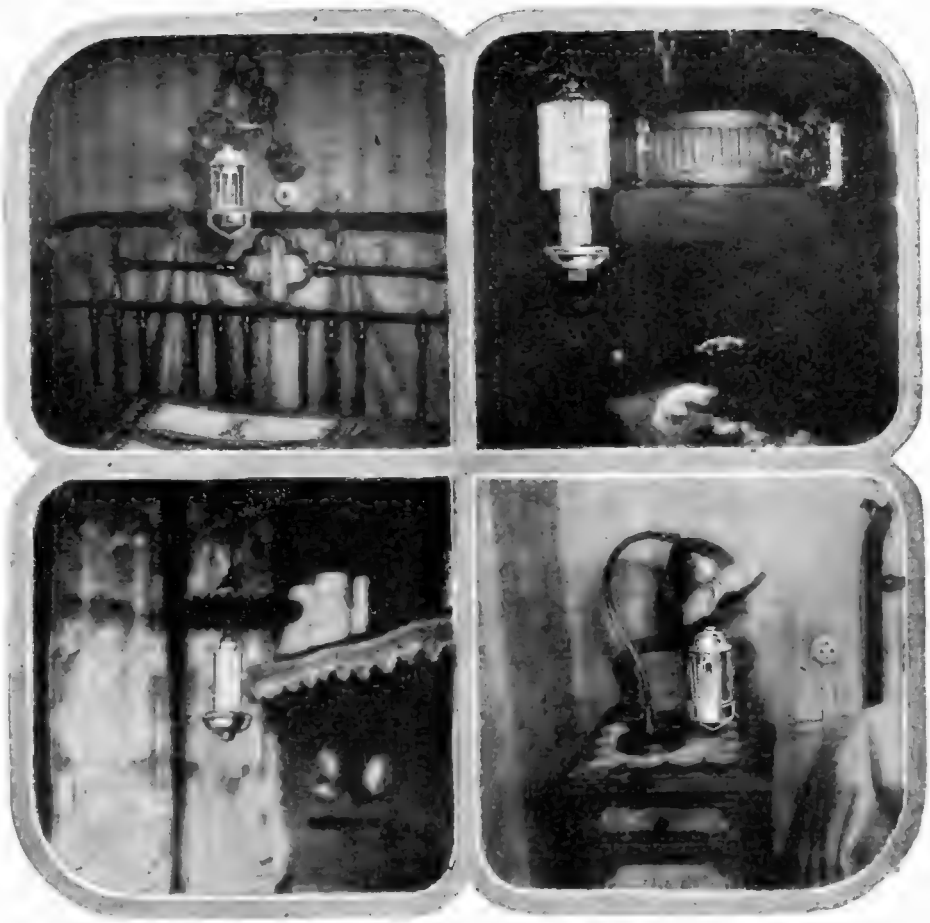
Electrocuting Flies

By A. N. MIRZAOFF

SUMMER has its pleasures but also its troubles. In our homes in particular flies worry us, but happily today we use efficacious means for destroying them, such as sticky paper, bottle traps in the form of vases where the insects drown themselves in soap suds, poison paper containing formaldehyde and which is called "Fly Paper," which is used by moistening it and putting it in a plate and has a deadly effect in its action upon flies who eat it. According to Trillat and Legendre, the best way to use this material consists in making a mixture 15 per cent. of commercial formaldehyde, 20 per cent. of milk, and 65 per cent. of water in large flat recipients. The flies attracted by the milk imbibe the liquid and their bodies fall in great bunches, not in the recipients, but around them, and sometimes at quite a distance.

But recently means for electrocuting this pest has been invented. The new electric fly killer consists of a strip or bar of insulating material, around which wires are wound, insulated one from the other. Each wire is connected at one of its extremities to one of the poles of an electric circuit; the other ends are disconnected. Now if a fly alights upon the bar it connects electrically the two wires, the spark flashes across and the insect is stricken with electricity. It then falls into a sort of a little bowl at the foot of the apparaus containing water along with a few drops of kerosene. As this recipient is attached to the bar by means of screws or a bayonet joint, it can be easily detached from time to time for throwing away the corpses of the flies.

The constructor has produced various models of electric fly killers which act with a current direct or alternating at 110 to 250 volts. Some are adapted for workshops or kitchen, others for stores, for restaurants or for living apartments. For bedrooms, the type adopted contains an electric lamp burning behind a screen arranged within a little cage, whose bottom is the cemetery for flies. The apparatus is placed above the bed, perhaps on the night table for example.

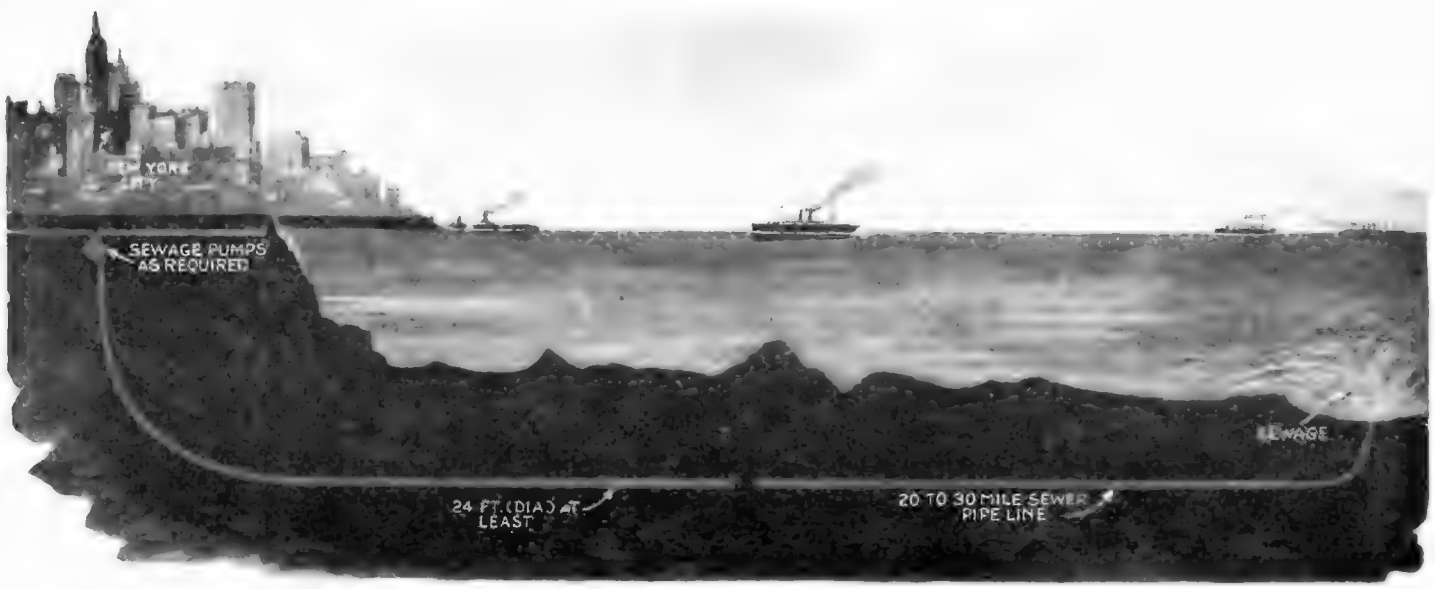


Above the fly-killer installed in the bedroom. Below is a view of the apparatus as used in the kitchen.

The fly-killer is camouflaged for the dining room; it is carried on a stand to protect a sleeper.

In the darkness of the room, the insects attracted by the light begin to fly around the fatal jar; they alight upon the wires, to which they may be attracted also by some sugar. It is to be remarked finally that this ingenious fly killer only consumes current during the instant of electrocution and consequently costs practically nothing to run.

Ocean Tube Eliminates Sewage



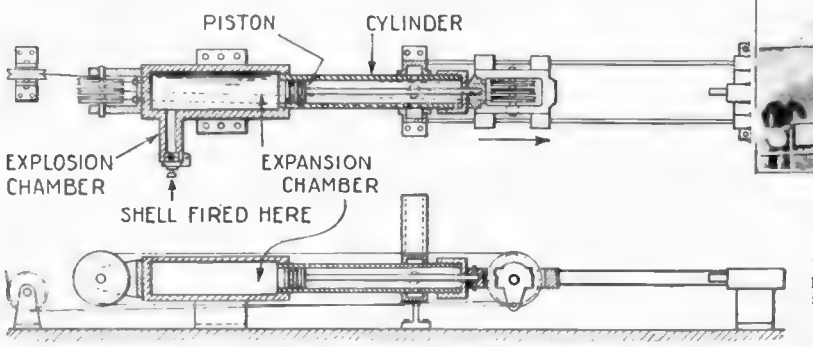
Edward Hatch, of the Merchants Pollution Committee has advocated special means for ridding New York harbor of filth. The suggestion has been made that tunnels or tubes be constructed under the city and far out to the sea under the ocean bed. The building of a tunnel 20 or even 30 miles under sea bottom is feasible.

Sewage pumps located beneath the city would force the refuse out beyond the harbor. Probably no other city in the world is called upon to dispose of its sewage under such adverse conditions as is New York, and the suggested plan should provide an efficient means for disposing of the waste matter.

Gunpowder Seaplane Catapult for Battleships

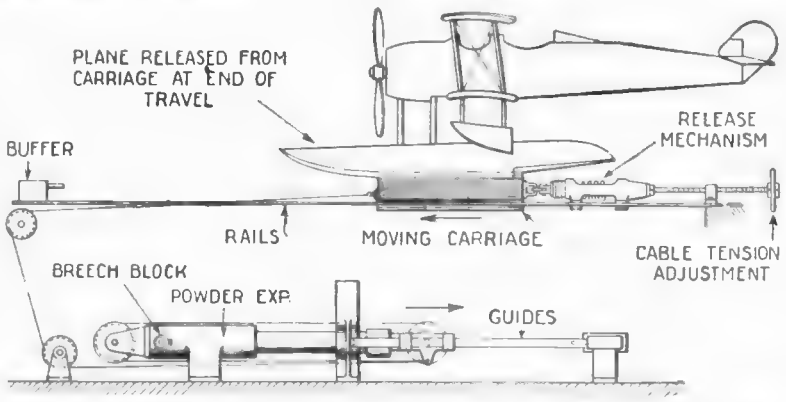
A NEW means of starting hydroplanes from the decks of battleships has just been perfected. This system uses a gunpowder explosion to provide the necessary motive power to throw the airplane from the turret of the ship. By varying the amount of powder used, the plane may be sent at any required speed into the air. The illustration shown here describes the method used in this new invention. The plane is hoisted onto a moving carriage on the catapult, and the engine is started. A specially-designed brass shell is placed in the explosion-chamber and fired. The expansion of the gas due to this explosion, moves a piston attached to a cable terminating at the moving carriage thus driving it with great speed along the runway. The moving carriage strikes the buffer which immediately stops it, and due to its inertia the airplane keeps on moving. The advantage of this system over the compressed-air system previously used is that the apparatus is much more compact and no heavy machinery is needed. The compressed-air system requires heavy machinery to keep the air at the correct pressure. With this new system any quantity of the shells may be stored in comparatively small space and thus innumerable flights may be assured. This system is being installed on many of our large battleships.

This illustration shows a 5,100-pound amphibian-plane being shot from the top turret of the U.S.S. West Virginia in Los Angeles harbor.



Details of the construction of the new catapult are shown in this illustration.

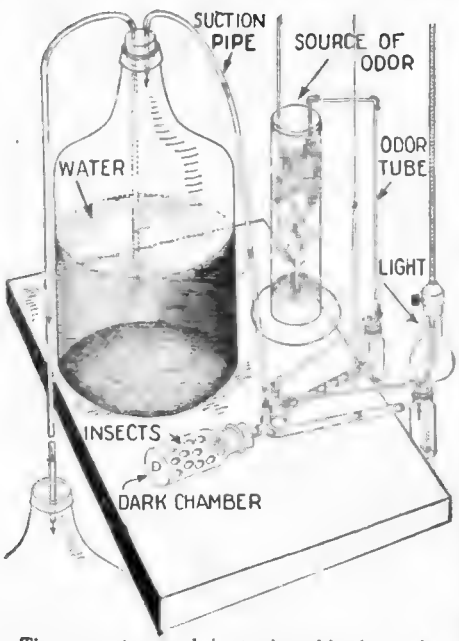
The complete catapult-action is shown here. The moving carriage on its rails and the buffer are shown; explaining the action that takes place in throwing the airplane into the air. The cable-movement is also shown in this illustration.



Good Light for Typists

THE best and most hygienic requirements of work bring the best results. It is evident that the rapidity and correctness of typewritten matter must suffer when the typist has her copy in an uncomfortable position, when the source of light is poor, or does not give sufficient illumination to the keyboard and manuscript. A very good solution of this problem is presented by a new conception, which is based on a characteristic lighting arrangement. The text to be copied is directly above the feed-roller, level with the eyes of the typist, so that she can read her shorthand copy without having to bend over. A lamp is so placed that its light is divided between the copy, the keyboard, and the paper. A metal screen which acts as a reflector prevents the light from dazzling the typist. The new copy-holder is screwed down on the surface of the typewriter-table, or is simply clamped there. A smaller light may be used, saving electricity.

Do Plant Odors Attract Insects?



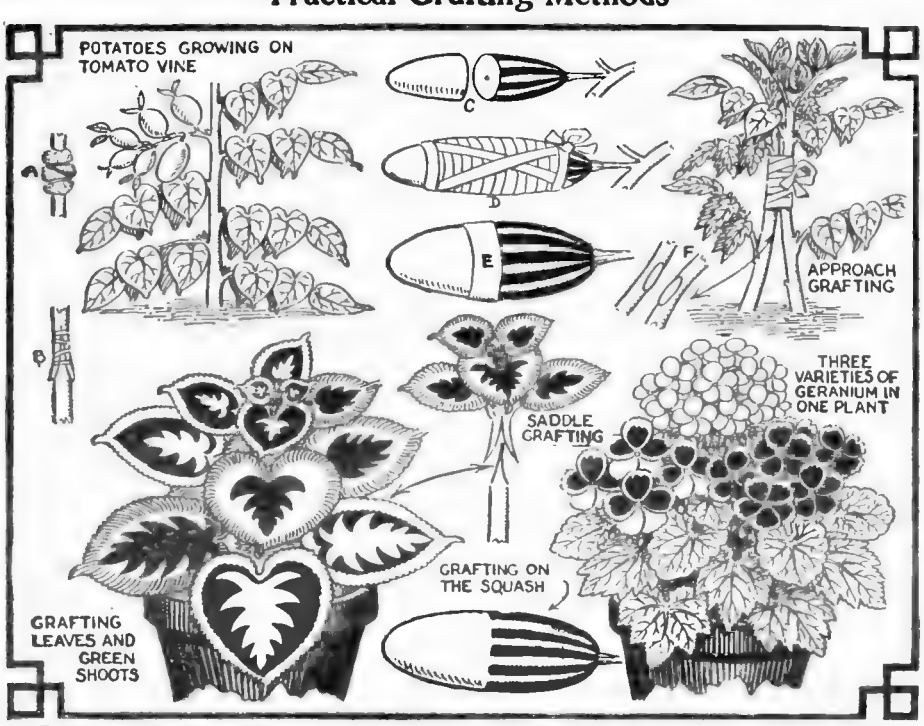
The apparatus used in testing this theory is shown above, and it will be seen that a majority of the insects follow the source of odor.

This illustration shows how plants may be protected by attracting insects with stronger odors than the living plants give into the specially arranged traps in which they are speedily killed.

ARE insects attracted to certain plants through their sense of smell? By duplicating certain odors artificially, can insects be lured to their destruction? Entymologists have been working along these lines for some time and are fairly positive that insects have definite senses which can be utilized by man in his continual warfare against them. The Bureau of Entymology of the U. S. Dept. of Agriculture has developed a sensitive instrument called an insect "Olfactometer," and by its use considerable progress has been made in determining the action on insects of odors from plant extracts, from plants, or from insects themselves.

Briefly described by Dr. N. E. McIndoo, entymologist of the U. S. Dept. of Agriculture, the insect "Olfactometer" consists of a specially constructed Y-tube through which insects pass from a dark chamber, being attracted by a light suspended near the free ends of the forks of this tube. The principle involved is to attracts the insects equally toward the entrances of the forks by the light stimulus, but when ready to enter these forks, they are influenced unequally by the odors drawn through the forks, thus leaving only the olfactory responses to be recorded.—*S. R. Winters.*

Practical Grafting Methods



The above illustration shows some unusual results obtained by grafting. Several methods are shown. The saddle-grafting is used to graft a branch of one specie onto a plant of another type. This is shown in the drawing of potatoes growing on a tomato vine. Another illustration of this method is shown in which the green shoots and leaves of one plant are grown onto another. The approach grafting is used to combine two growing plants to produce unusual fruits and leaves. It would be rather queer to start eating a cucumber, and when half through discover one was eating a squash. The method is shown in the illustration.

Author please send name.

A Buttonhole Tip

If you have ever worn a flower in your buttonhole and wished you could have kept it fresh, you will appreciate this tip.

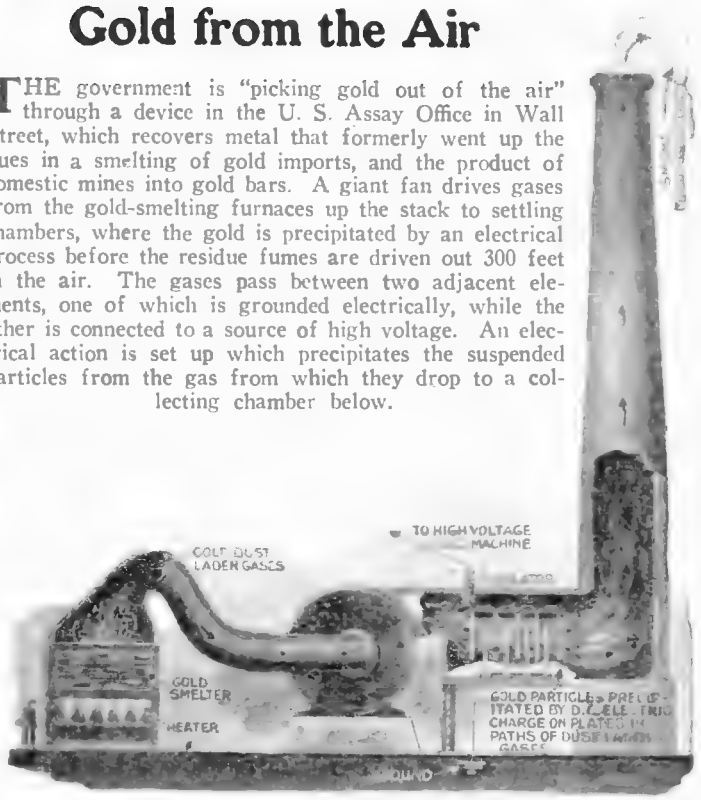
WHEN flowers are used for buttonhole or bouquets they are apt to fade rather quickly. In such cases a very good thing to do is as follows: Soak a piece of cotton-wool in salt and water. Then wrap this around the end of the stalks. Enclose the cotton-wool with a piece of tin-foil, and you will find that the flowers remain as fresh as if they were in a vase of water.—*S. Leonard Bastin.*

Photographing Electric Flashes

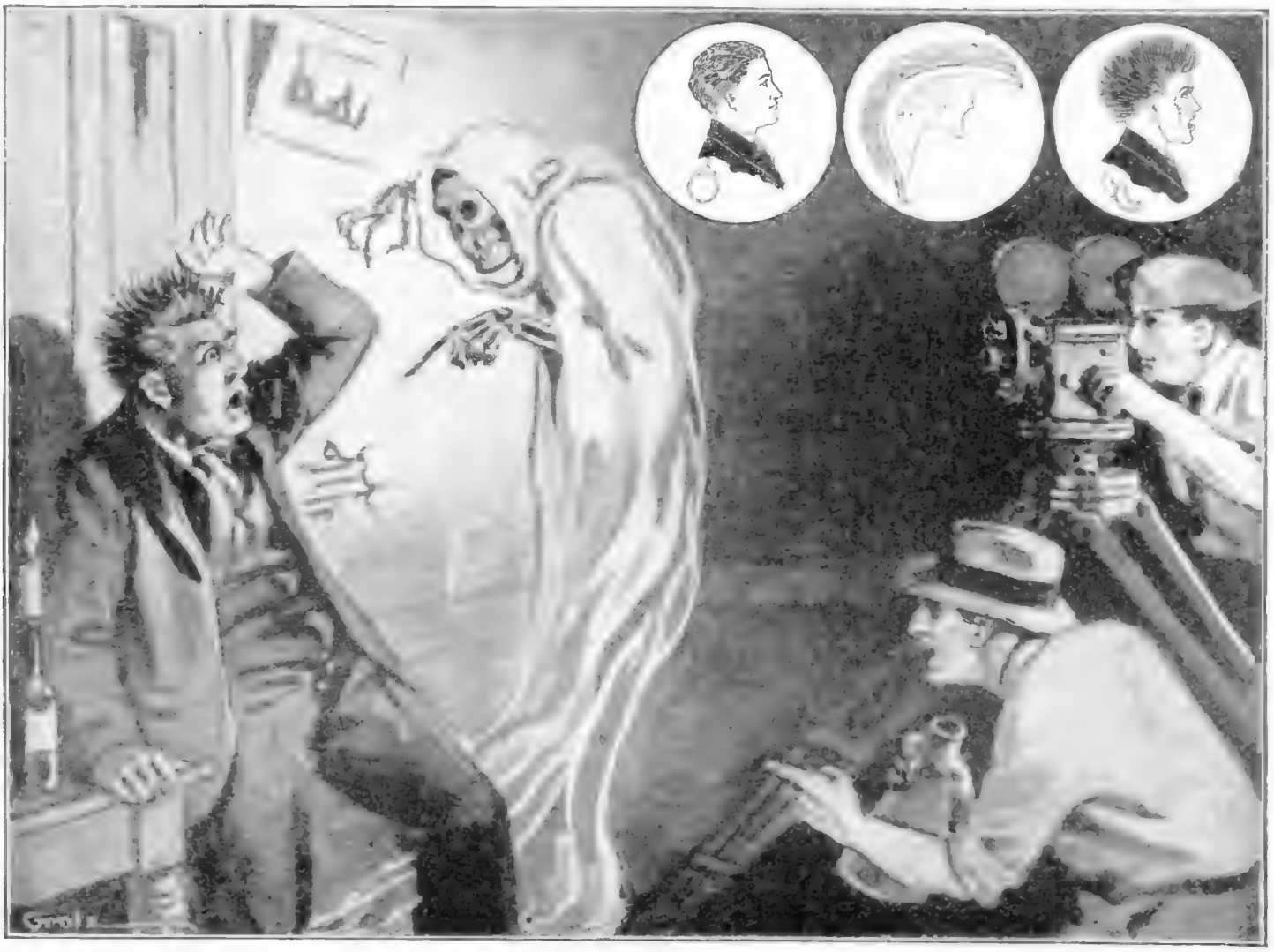
As a result of an invention of a camera which will take photographs at a rate of 2600 a second, the pictures shown of electric flashes may be analyzed. "A" shows an electric flash eight feet long as seen with the naked eye. "B" shows the actual contorted path followed by a flash as disclosed by the new camera.

Gold from the Air

THE government is "picking gold out of the air" through a device in the U. S. Assay Office in Wall Street, which recovers metal that formerly went up the flues in a smelting of gold imports, and the product of domestic mines into gold bars. A giant fan drives gases from the gold-smelting furnaces up the stack to settling chambers, where the gold is precipitated by an electrical process before the residue fumes are driven out 300 feet in the air. The gases pass between two adjacent elements, one of which is grounded electrically, while the other is connected to a source of high voltage. An electrical action is set up which precipitates the suspended particles from the gas from which they drop to a collecting chamber below.



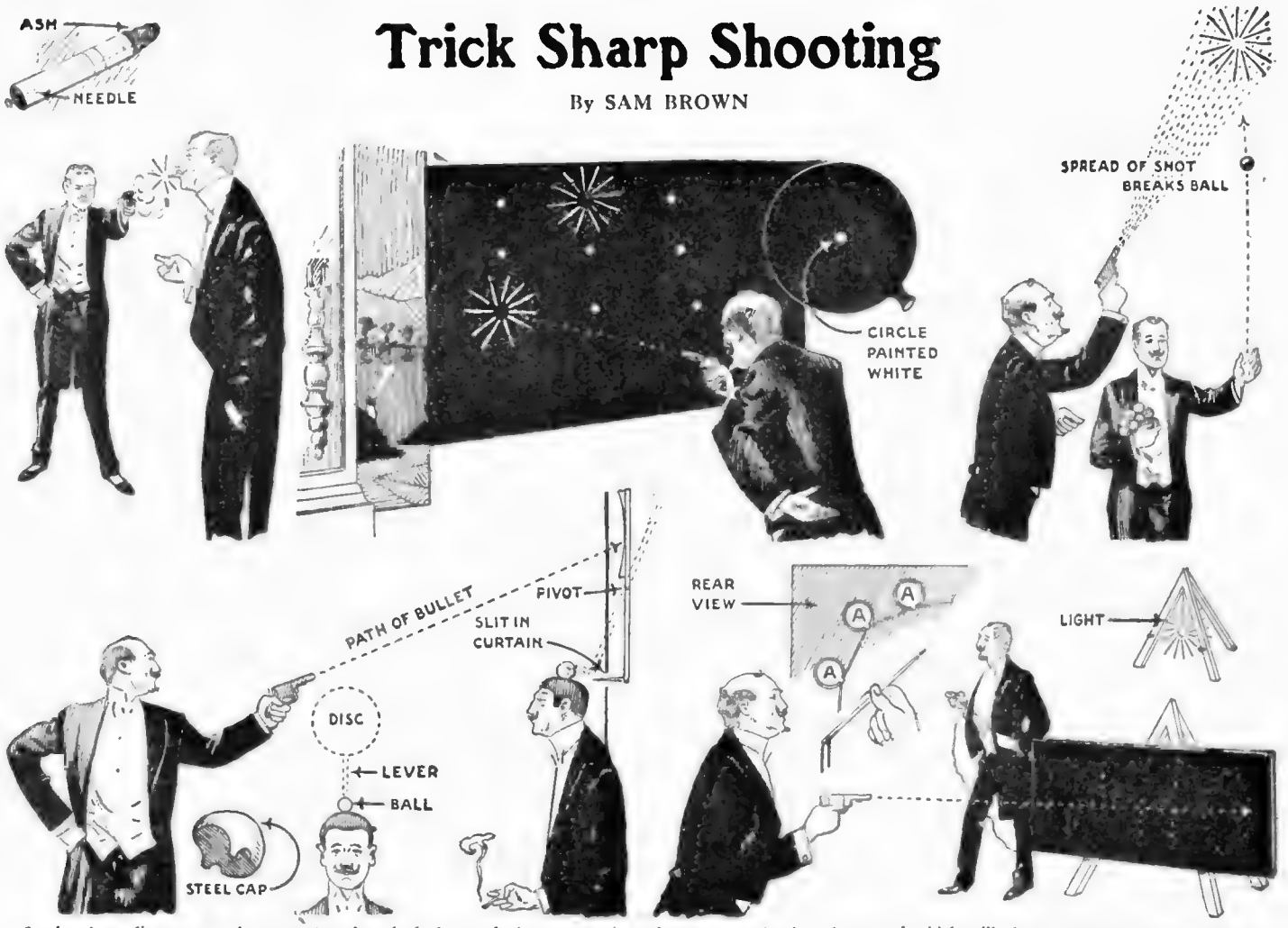
Hair-Raising Trick Used in Motion-Picture Photography



An invention devised to provide a means whereby the hair of a wig can be elevated or made to stand on end, so that the wearer can register fear, by elevating the hair and changing the expression on his face, has just been patented. This wig which is of great assistance in motion-picture photography also provides a means for holding the hair elevated as long as desired. The inserts show the method of constructing the wig. A tube is attached with the rear part of the wig, and its other end connected with a bulb which will inflate the wig member and cause the bristles to rise when the air enters it.

Trick Sharp Shooting

By SAM BROWN

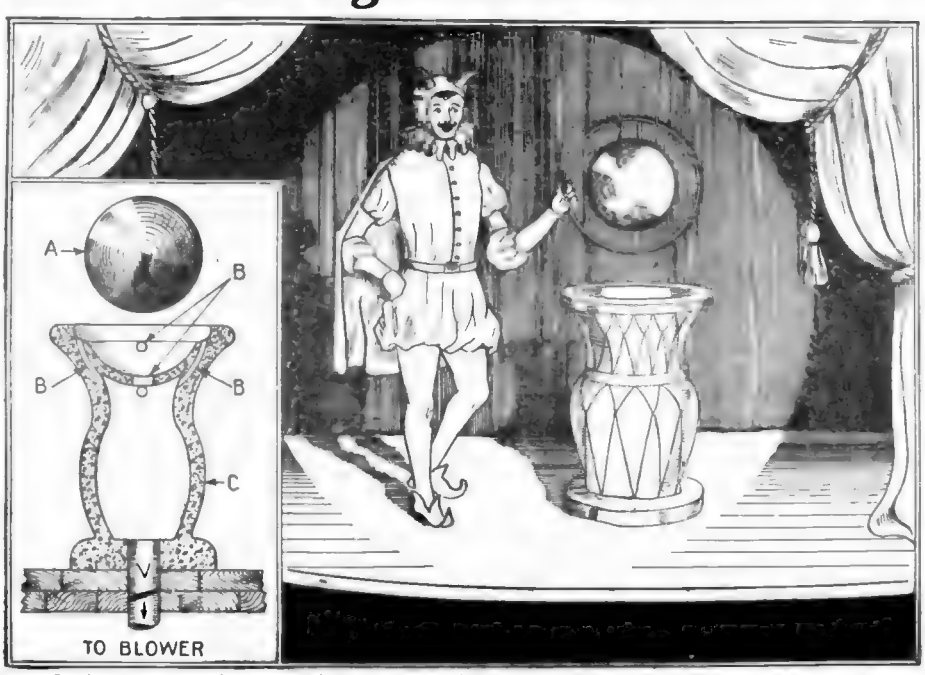


In the above diagram we show a series of methods for producing very realistic trick sharp shooting which may be used by amateurs for minstrel performances and other shows and which will show extreme apparent skill at handling a rifle or a revolver. The methods are explained in the text.

PROPERLY presented there is no way to detect fake sharp shooting from the real thing. In the case of hitting a ball in mid-air instead of using a single shot from a revolver or rifle, the sharp shooter employs buckshot, which spreads over a considerable territory. The two-gun man who hits two balls thrown simultaneously uses one gun with bird shot and another containing a blank. A series of minute white targets can be destroyed rapidly by painting a white dot on a black balloon and then placing the balloon in front of a dark background. A shot striking within six inches of the white spot will cause the spot to vanish. In the cigarette trick a blank is used in the gun and a pin held between the teeth releases the cut tip of the cigarette. An apple may be shot from a person's head by hitting a target placed above and in back of the background. A pointed wire strikes the apple, knocking it from the man's head. A name may easily be punctured in a cardboard if the cardboard is cut and threaded as indicated at A, A, A; jerking the thread tears off the tiny retainers in rapid succession. The light shows through the openings thus formed. A steel punch may be used to cut the name in the black cardboard. The punch should be quite sharp and thin. Blank cartridges are used.

The Magic Ball of Zanoni

THE magic ball of Zanoni is a ball which, at the command of the operator may be made to slowly rise from its resting place and remain suspended in air while the operator passes a hoop completely around it. Then, at command, the ball may be made to dance a jig to the merry tune of the orchestra. The ball itself is constructed of cork, celluloid, balsa wood or other light material and is shown in the detailed drawing. The pedestal is made of concrete or any other material and is painted to harmonize with the magician's other paraphernalia. At B there are a series of openings which lead from the inside of the pedestal to the top of the stand, and at the bottom there is a tube communicating directly with a blower located beneath the stage or for that matter the blower itself could be mounted in the pedestal making the device more portable. By controlling the valve either from back stage or by the operator's foot the ball may be made to rise or fall at will. There is only one objectionable feature to a stunt of this nature, and that is that the noise of the escaping air can be heard and consequently an orchestra should play while this stunt is being produced. Inasmuch as the ball is made to dance in time with the music, the music acts as a perfect mask, and seems to be an addition to the performance.—*J. Butzer.*

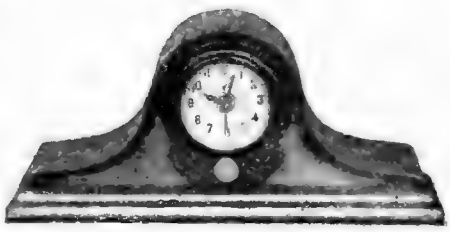


In the diagram at the left. A is the ball; B, air passages; C, vase; V, air channel with valve.

LATEST DEVICES *of* THE MONTH

The false eyelashes shown in the above photo are the latest in beautifiers. The eyelashes are made in various sizes and shades to suit the individual taste of the wearer. They may be attached at a moment's notice and will stay in place all day long even though the wearer may take violent exercise.

Courtesy C. Nestle Co.

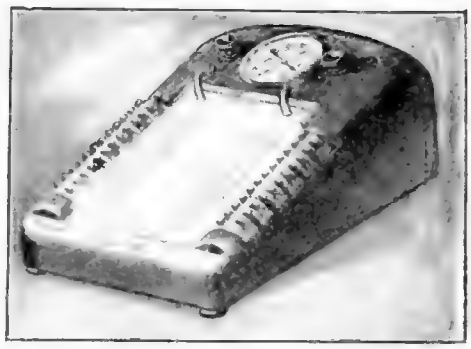


An automatic radio timer clock is shown above. By means of this ingenious mechanism it is possible to turn the radio set on or off at any desired time. The clock can readily be placed on the radio receiver itself.

Courtesy Timing Appliances Corp.

The device shown above stops mouth breathing and snoring. A comfortable cap-like affair is fitted with an adjustable strap which passes beneath the chin.

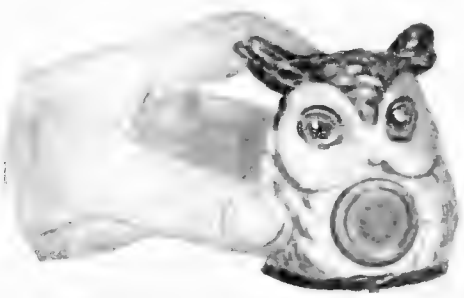
H. P. White.



"HORO-MEMO."

Above is a new device for office use which has recently appeared in Paris. Each day has its sheet, and this is ruled off at the right and left hand sides into one-quarter hour spaces. There is a key to correspond with each space, and this is turned opposite the space which has been marked. A bell rings at each marked quarter of an hour.

Courtesy C. Mamet & Co.



NOVEL CIGAR LIGHTER

The cigar or cigarette lighter pictured above will doubtlessly be welcomed by many smokers, both for its pleasing appearance and for its usefulness. The lighter is small and compact and can be easily held within the palm of the hand. It should find and fill a needed place in the den or club room. The lighter has a switch in back of the body. It connects with the house lighting circuit by means of a cord and plug. Resistance wires beneath the mica window become heated to incandescence when in use. This lighter will eliminate the fire hazard which is always attached to matches.

Courtesy Owl Mfg. Co.

GOLF AID

The putting aid shown above will do much to improve the golfer's score, if used assiduously. It has been designed to correct any faults in the golfer's stance and to enable one to get the correct swing.

Courtesy P. A. Vaile.

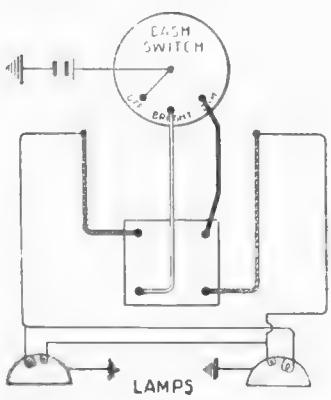
TOOTHPICK VENDER

The automatic toothpick server shown above and to the right will eliminate the unsanitary way of handling all toothpicks. Simply press on the lever and a toothpick jumps up. This article will be found very handy in the home as well as in restaurants.

J. B. Roswick and Standard Mfg. Co.

NEW HEADLIGHT DIMMER

A photograph of the headlight dimmer with the cover removed is shown above. Note the contacts and the heavy spring which keeps the push button raised. The mechanism can be quickly installed on the floor of the car within easy access of the driver's feet. It should eliminate many accidents which occur when driving at night, usually caused by blinding headlights. At the right, the connections for the headlight dimmer to the switch on dash, are shown.



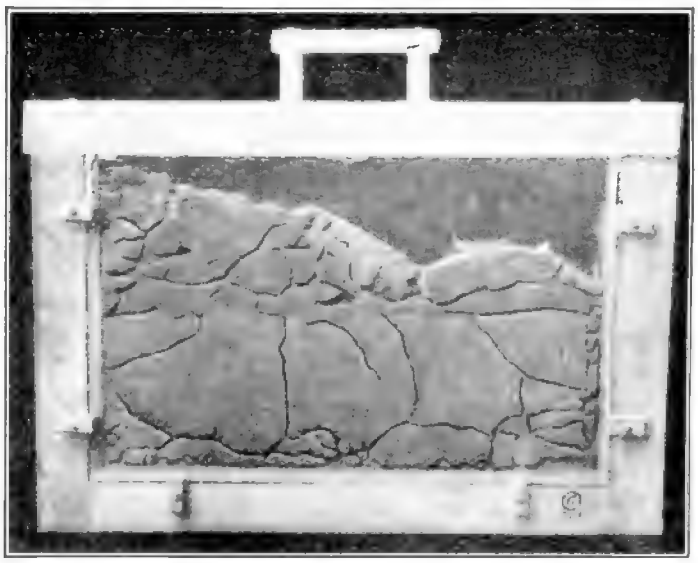
A view of the headlight dimmer installed with the cover removed.

Courtesy Barkelew Electric Manufacturing Co.

Artificial Fog Latest German Military Device

German military and naval forces are reported to have made successful experiments with a new "artificial fog" which screens an area almost completely. The fog is chemically produced, and the reagents used in its production may be carried in small containers. It is claimed that the fog is harmless, except as it causes slight coughing among those who spread it.

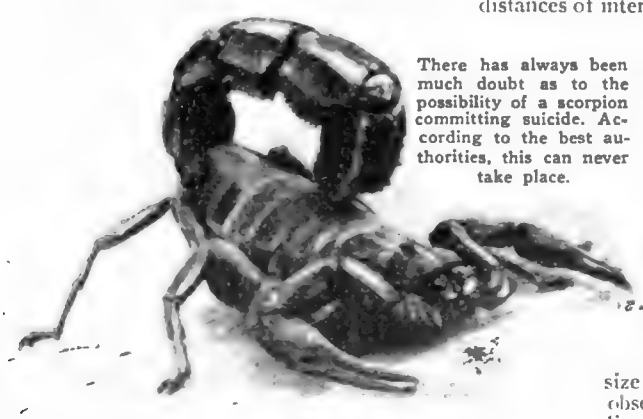
Nature Study Afforded By Captive Ant Colony



Ants may seem rather unusual creatures to keep as pets, but they may be confined in a glass cell, as in the photo above, and will afford much instruction and amusement. Two glass plates are spaced about ½ inch apart, and the intervening space is filled with dampened, screened sand and loam in which the ants will burrow.—Prof. F. E. Austin.

Suicide Among Scorpions

COUNT A. N. MIRZAOFF recites that he has been able to make scorpions commit suicide by encircling them with a ring of hot coals.

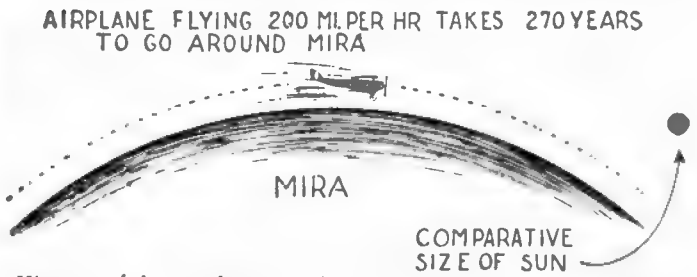


There has always been much doubt as to the possibility of a scorpion committing suicide. According to the best authorities, this can never take place.

While scorpions themselves are not extremely poisonous creatures, they are dreaded by the natives of Central Asia. Bites from several scorpions can produce death.

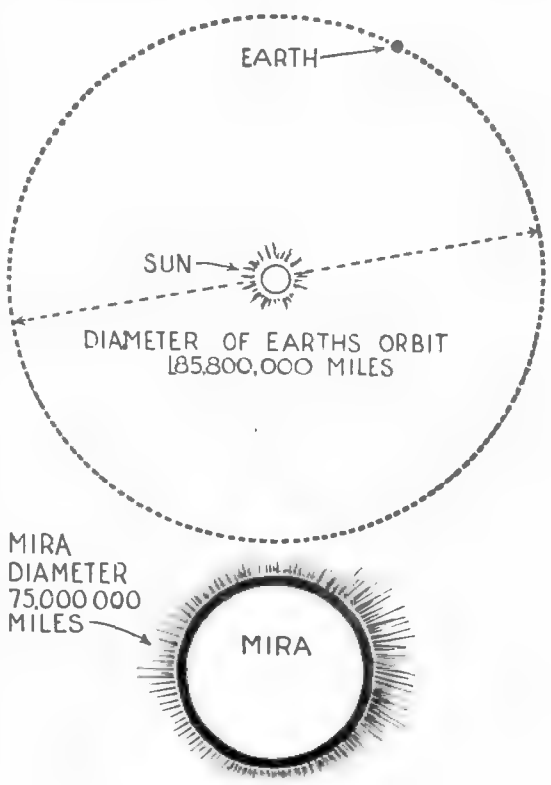
Authorities claim that scorpions never actually puncture themselves or each other, even when fighting. They cannot be induced to sting themselves by a ring of coals or by any other method except force. Their poison does not affect them. Practically every poisonous animal is remarkably resistant to its own poison. What probably happened was that the scorpion was scorched to death.

Giant Star Dwarfs Universe



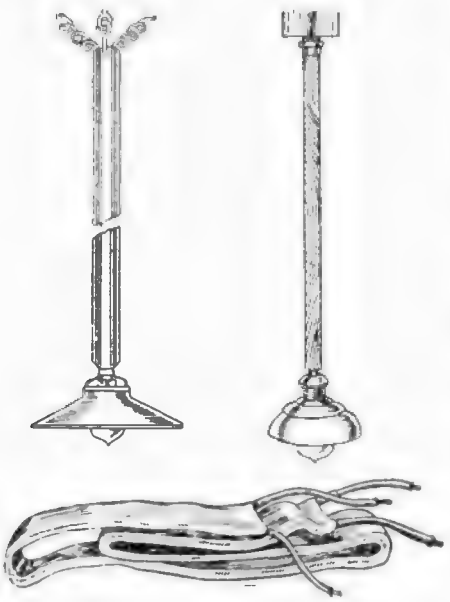
Mira, one of the most important of the variable stars, is so large that an airplane at 200 m. p. h. would take 270 years for a complete circuit.

WE are accustomed to think of our sun and our universe as the ultimate in magnitude. The astronomers tell us, however, that the distances of interplanetary space are utterly incomprehensible to the human mind, and that some of the bodies in this space exceed our conception of immensity. One of these heavenly wanderers, known as a variable star because of its periodic changes in brilliance, is Mira, *Ceti Omicron*. Estimates of Mira's size vary with different observers from 75 million to over 300 million miles in diameter. The two drawings given here will help you to imagine how truly tremendous this star is. To give some idea of the size of one of the far-distant variable stars of our solar system, a conservative estimate of Mira's size gives it a diameter considerably over two-thirds as great as the distance from the earth to the sun disclosing a mass beyond human conception. —C. N. Holmes.



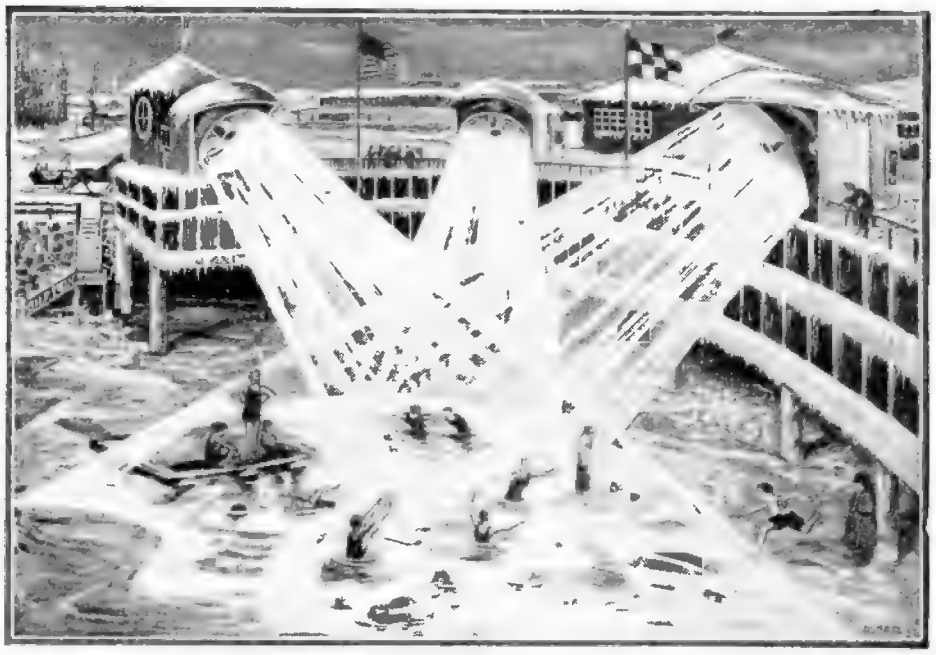
Antique Electric Lights

The illustrations below show the evolution process through which the present day drop-light passed. The lamp at the left was supported by small strips of molding and



came into use in Europe in 1883. The other drop-light was popular in this country at the same date. At the bottom of the drawing is an illustration showing the first flexible lamp cord which consisted of conductors sewed in the edges of a woven fabric. This suspender-like arrangement was used in the Edison home at Menlo Park in 1881.—*Edison Monthly.*

Summer Bathing in Winter Time



BY using concentrated heat rays, it will soon be possible to enjoy your morning's dip in the ocean, despite the fact that it is mid-winter. Several large electric heaters are fitted with reflectors so that the heat rays may be concentrated and directed to any spot desired. These concentrated heat rays will melt the ice and snow and warm the water. The bathers will be able thus to enjoy a beneficial salt or fresh water swim in the heart of winter. This novel scheme was suggested by a German genius.

SECRETS OF THE FLOWER

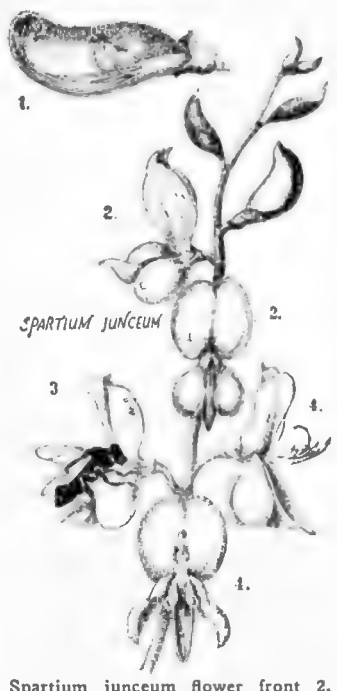
By DR. ERNEST BADE

(*Concluded from July issue*)

IN another flower of the same species, the style or tube of the pistil has been lowered and when the bumble-bee visits this flower the style rubs on the back of the pollen laden insect and a number of pollen grains adhere to the gluey surface of the stygma whereby the flower is fertilized which may now proceed to seed formation thus insuring the continued existence of the species. The movable lever arm of the first flower returns to its normal position when the bumble-bee leaves the flower and is thus able to give another light shower bath of pollen to the next visitant.

A different method is employed by some of the *leguminosae* to provide the honey seeking bees with their pollen. A kind of a hurling device is used in the family of Spartium as well as among some others. Here the lower lip of the flower, which gives an easy method of entrance to the flower, is connected to the pistil and the anther and both are in tight tension, like the spring of a watch. When the bee arrives on the landing stage of the flower, its weight presses the floral leaves downward whereby the anther and pistil are revealed. The anther presses against the abdomen of the bee covering its hairy body with pollen by means of hurling the grains against it. The bumble-bee hardly notices this and continues its search for nectar. Such an opened flower is seldom visited again for the bumble bee has provided the pistil with pollen taken from previous visits to other flowers of this species.

The long flowers of *Aristolochia* are provided with downward pointing hairs in the early parts of life. This permits tiny insects to enter but not to pass out. And as these creatures seek a way of escape, they circle the inner part of the flower again and again, the anthers, in the mean time drip pollen grains and when the insects are covered with them, the hairs which prevented the escape of the insects, fall off and so permit the creatures to emerge from their trap. Then the tiny insects go to another flower and fertilize it with the pollen unwillingly taken from the first flower. When this has been accomplished the flower closes by means of a floral flap which originally was erect but now covers the entrance to the flower.



Spartium junceum flower front 2, side 2 closed and 4 opened. Flower opened by bee 3. Section through flower showing pistil and anthers 1.

The beautiful flower of *Yucca filamentosa* is entirely dependent upon the Yucca moth (*Pronuba yuccasella*) without whose aid it is incapable of producing seeds. But on the other hand the moth can not propagate its species without the plant. The female of this moth goes into this flower to seek pollen.

With this ball of pollen the moth leaves the flower and seeks another one. Here it looks for the pistil and places the ball of pollen on the stygma after depositing a few eggs in the style. The pollen fertilizes the flower and, after a few days, the eggs hatch and the tiny caterpillars feed on about twenty seeds.

Another peculiar method of propagation is found in the tape grass (*Vallisneria spiralis*) a water plant much cultivated in aquariums. The male flower is produced within two transparent leaves which have come together to form a bubble. They are found under the water near the bottom where they cluster together like the grapes. The female flower develops a long spiral thread, which lifts the flower slightly above the surface of the water. At the time of fertilization the male flowers loosen themselves from the plant and rise, one by one, to the surface of the water. Here the flower opens and three leaves fold back and expose the anthers. This entire device resembles three miniature boats held together at one point and it is from this central point that the anthers rise slantingly upward. The boats are carried hither and thither by the wind not capsizing nor shipping water. They float aimlessly about until they come to rest near some solid substance especially if it is slightly indented like the leaf of the female flower. If the two parts of the flower do come in contact then the pollen is given to the female flower thus fertilizing it. Then, in a little while the flower is again drawn under the surface of the water due to the twisting of the long stem carrying the female flowers. The windings of the cork-screw like thread gradually are brought closer together so that the seeds, when they are finally ripe, are very close to the bottom.

The Hon. John Collier's famous painting "A Glass of Wine With Caesar Borgia" in which a Roman noble is being forced to drink a glass of wine that he suspects is poisoned, by Caesar Borgia (head bowed) while the beautiful Lucretia Borgia looks on.

Traceless Poisons—Nonsense

The Dead Tell Too Many Tales and Besides Science Knows All About How Poisons Act

By UTHAI VINCENT WILCOX

IT seems that the use of poison as a favorite method of committing a crime is fast dying out in the United States. National records show that there has been no notable cases of the use of poison for more than a decade.

Such things as "traceless poisons" exist only in fiction say medical authorities. Deputy Police Commissioner Joseph Faurot of New York City and Edward H. Smith, both of whom have made life long studies of poisons and their effects, find that the use of poison for criminal purposes is made exceedingly difficult because poison is very hard to procure, contrary to popular belief.

"The old saying that dead men tell no tales," explained Mr. Smith, "is far from the truth in this scientific age. Every body tells its own tale, either chemically or physiologically. And the test tube is the silent witness that sends most poisoners to the scaffold.

"Of course in fiction it is necessary to create weird poisons that leave no traces, one of the most popular with the writers being the East Indian herb dhatura. But the poisoner who learns his trade through reading will not practise it long. For, be it dhatura or arsenic, each leaves an indelible record for the laboratory or dissecting rooms.

"Mineral poisons such as arsenic or the cyanides leave definite chemical deposits in the body that can be easily shown in court by a few standardized chemical reactions. Vegetable poisons do not leave as a rule such definite chemical traces but on the other hand they make certain changes in the human body that are easily recognized as the evidences of the use of that particular poison.

THE CHEMIST AN AID

The modern detective who wages his wits against the poisoner is the anatomist, toxicologist or analytical chemist and the would-be criminal has to go to the greatest lengths to hide his tracks. One of the cleverest cases of the latter type was that of Dr. Robert Buchanan, who gave two poisons, one to hide the traces of the other. He first administered morphine to his wife and then belladona to dilate the pupils of her eyes. The result was that two physicians who attended the dying woman laughed at the suggestion of morphine poisoning, because she showed none of the well known symptoms which particularly are the contraction of the pupils of the eyes. Yet in the end chemistry proved the presence of poison in the dead woman's body, in fact unravelled the mystery of her symptoms, by showing that one poison had been used to hide the other.

Similarly in the case of the death of multi-millionaire Colonel Swope of Kansas City, the state in its case maintained that a mixture of strychnine sulphate and potassium cyanide was administered. The reason claimed for this mixture was that strychnine acts upon the nerves controlling the action of the heart and produced convulsions and other marked and characteristic symptoms of the poison. On the other hand cyanide has a tendency to congeal the blood and slow the heart in a most remarkable manner, so that it might well be expected to confuse or conceal the strychnine poisoning symptoms at the same time adding to the deadliness of the dose.

"Some overwrought layman decides that his mother-in-law is superfluous and that poison is the safest remedy for the situation," says Mr. Smith. "He looks over the last detective story and picks out some weird

(*Continued on page 373*)

The Romance of

By JOHN V.

A splendid symposium showing the methods employed in the making of modern carpets. How you can know a Velvet from a Chenille weave and how you can tell the difference between a good and poor carpet is clearly outlined.

Fig. 1. "Starving" artist at work. Note 1,996,000 squares must be filled in by designer in 9′ x 12′ pattern. In a Karnak Wilton rug this takes from six to eight weeks.

THE story of modern power loom production of woven floor coverings in this country, equals in wonder and romance the oft-repeated and sometimes highly colored history of Oriental rug weaving. The progress made in the last two or three years brought the art to a degree of perfection excelling that of any previous period and it will be our purpose to disclose how the United States has come into international leadership in this textile industry.

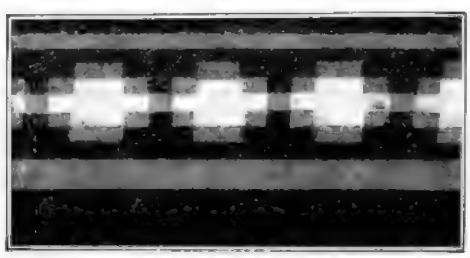


Fig. 2. This illustration shows a section of an Axminster rug.

In Colonial times the few floor coverings were produced in the home, much as the real Oriental rugs had been made for many centuries previously. There were hooked, braided, and rag mats at first, the latter made on hand looms; upon the looms simple weaves were effected, among the first being Ingrain and Smyrna. Both of these have been replaced by more practical and serviceable makes and today the Tapestry, Velvet, Axminster, Wilton and Chenille fabrics are in popular demand. One leading corporation in this country alone produces 75 qualities in the five types of weave above mentioned, to fill the varied needs and price range of American consumers. From a $10.00 room-size rug in Tapestry all budgets are met until we go into the thousands in Chenille, woven in any shape, any color or

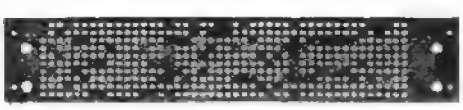


Fig. 3. The design which the artist has made on squared paper is cut up into strips 9 inches wide. These strips are given to a girl who follows the tiny squares of color provided by the artist by punching holes in a piece of heavy cardboard 3" x 17". This is called a Jacquard card.

arrangement of design, over an inch in thickness, and reasonable length and up to 30 feet in width and seamless; $10,000.00 has been paid for such a masterweave which weighed over a ton and measured 25 × 48 feet. It may be mentioned in passing that this particular Chenille rug took 10 weeks in actual time for the weaving alone.

**Educational Director Mohawk Carpet Mills, Inc.*

The surface yarn for rugs is made from carefully selected wools from sheep living in mountainous sections. Such animals develop wool which is lustrous, strong, has long fibers and is very resilient. These sheep live out-of-doors the year round, the wool coming principally from China, Thibet, India, Syria, Egypt, the Argentine, Iceland and Scotland. The wools of many different countries and from many types of sheep are mixed to obtain what is considered the proper blend for the yarn necessary to the particular weave and quality of the fabric to be made. Woolen yarn spun from the common grades of wool in the mule spinning system, which in this particular case is a mechanical mule and not the animal, is of a fluffy nature and gives the carpet its body. Worsted yarn, in contrast, is spun from selected long staples on the drawing or worsted spinning frames. The short fibers have been previously combed out.

Strong cotton yarns are used in warp and filling and serve to bind the surface yarn to the warp or back. In the cheaper qualities of carpets, jute, grown in India, which is another vegetable fiber like cotton, is used for the warp or back of the fabric.

Given these raw materials, we can briefly follow the modern methods of weaving. Before any work can be done, it is necessary for designers to provide the pattern. This is accomplished on sheets of cross-section paper, a little larger in size than the size of the floor covering to be woven. An artist at work on his immense easel drawing and painting in the design is shown in the photograph in Fig. 1. The tiny squares on this paper are printed with a predetermined number each way, the width number deciding the pitch of the weave or the number of tufts of wool in the width, while the vertical number accounts for the "beat-up." Multiplying the numbers (width × depth) in each square inch of the fabric, we obtain the "count." The count is, therefore, the number of tufts of yarn in each square inch of the rug's surface. The artist must bring all his knowledge of design-motive and color harmony into play, realizing, of course, the limits placed upon him as to the number of colors which are to be used in a certain type of weave. He must provide a pattern that is authentic in derivation, adaptable to present-day decoration, geometrically perfect, and therefore saleable. (Fig. 2.)

Fig. 4. This shows a Jacquard Wilton loom with the pattern cards in the top (1) and the six frames of colored yarn in back (2).

WILTON RUGS

We will now describe how the popular Wilton rug is woven.

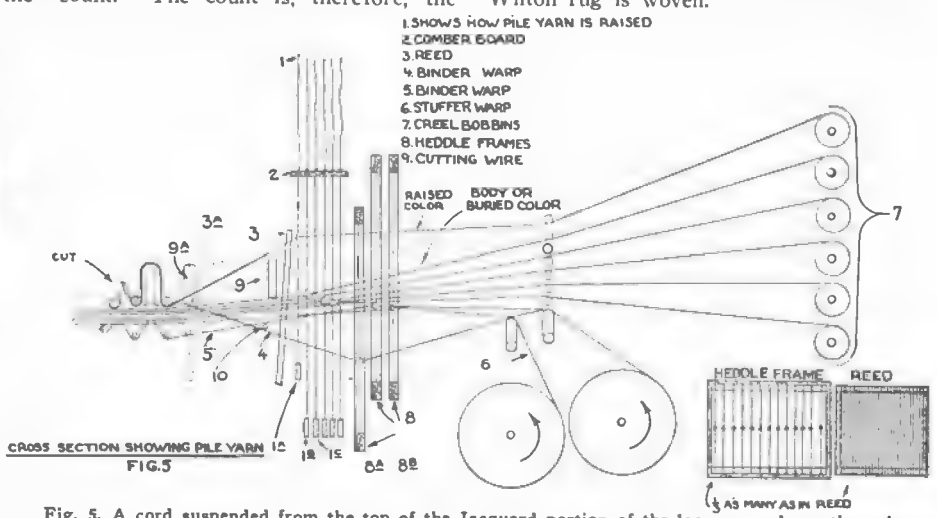


Fig. 5. A cord suspended from the top of the Jacquard portion of the loom runs down through the index needle. When the index needle drops through a hole in the Jacquard card, the card also drops. Thus, when the needle is lifted, the pile yarns threaded through the eyes in the needle will also be lifted and will be brought to the top. The drawing indicates one of these needles lifted and in position for the insertion of the pile wire.

Modern Carpet-Making

SMEALLIE *

The design which the artist has made on the squared paper is cut up into strips nine inches wide. These strips of design paper are given to a girl who follows the tiny squares of color provided by the artist by

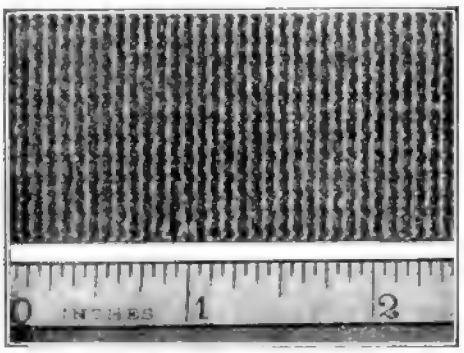


Fig. 6. This is the back of a Wilton weave. It shows the manner of proving the number of wires in the Wilton rug. The photo indicates 13½ wires to the inch or 27 to 2 inches of fabric.

punching holes in a piece of heavy cardboard 3″ × 17″ in size. (Fig. 3.) Wherever a hole is punched in the card the particular colored yarn will be subdued, and wherever there is a blank space in the card, that strand of yarn corresponding to the blank space will be brought to the surface or will be called up over the pile wire. We shall mention pile wires again and explain them more fully. After six or seven weeks of work,

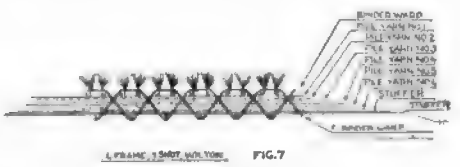


Fig. 7. A flat wire with a knife edge when withdrawn, cuts the surface yarn which had been wound over the wire. The surface yarn then stands on end, giving us the plush effect of a Wilton rug.

the card stamper will have provided more than 23,000 cards for the pattern of a good quality 9″ × 12″ rug. These cards will control the placing of 22 colors when they are laced together and hung at the front and top of a Wilton loom. The cards are called Jacquard cards and operate this type of loom something like a player piano. (Fig. 4.)

Back of the loom six trays or frames of yarn can be seen. These are of two- or

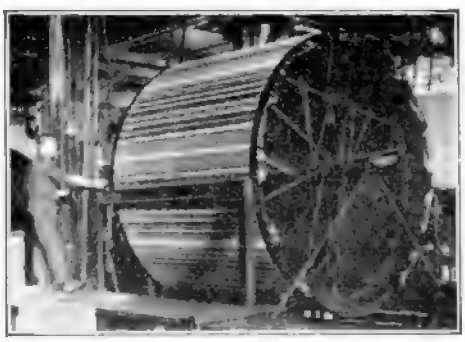


Fig. 8. In tapestry and velvet rugs, the natural yarn is wound around large drums approximately 31 feet in circumference. The operator prints colors on this wheel with the aid of analine dyes.

three-ply woolen or worsted and as many as 256 spools in each frame are provided for a 27″ or so-called three-quarter width of weave. Usually each frame will carry a different color, but additional colors can be planted here and there by expert designing in order to provide more than the five or six major colors in the pattern. The yarns are brought into the weaving position together; five or six yarns, that is, one from each tray will go through each split or bent in the reed. The reed is like a comb made up of a number of parallel strips set closely together in a rectangular frame and serves to separate the individual yarn and also to drive the filling against the face of the fabric just woven. The pattern card will call up the desired color in each split over the pile wire. This means (note Fig. 5) that a cord is suspended from the top of the Jacquard portion of the loom and runs down through the index needle. Now when the index needle drops through a hole in the card, the cord also drops. The cord itself is provided with a knot which passes through a lifting board and is attached to

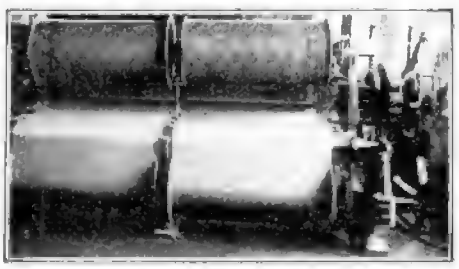


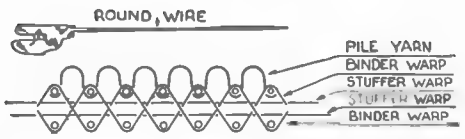
Fig. 8A. The back of a tapestry loom. The upper beams contain woolen or worsted yarns making the surface of rugs. The lower beams are jute stuffer forming part of rugs backing. Cotton warp beams are beyond the jute beams.

the heddle frame as the drawing indicates. It is natural then that when the heddle is lifted, the pile yarns threaded through the eyes in the heddle will also be lifted and will be brought up to the top. The drawing indicates one of these heddles lifted and in position for the insertion of the pile wire. The pile wire itself is a thin rod of steel which is inserted by machinery into the proper position, under the thread. It is thus obvious that when the loom proceeds to its next position, the thread again being depressed and the shuttle having been driven across and the filling yarn beaten up by the reed, a loop of yarn will have been formed over the pile wire. If the pile wire is withdrawn, we obtain a group of loops clear across the carpet. These loops with a round wire are naturally uncut and we get what is

Fig. 9. When a round pile wire is used in the loom, leaving an uncut loop of surface yarn, we obtain a tapestry round wire. This photo shows a tapestry and velvet loom.

known as a "Body Brussels." Those pile yarns not used in the pattern, are hidden beneath the surface and, of course, are part of the fabric. They become woven in the back and give origin to the term "buried value." The "body," therefore, refers to the "buried yarn" and "Brussels" to the city in Belgium where the weave originated.

If instead of using a round wire we had employed a flat strip of steel fitted with a sharpened knife blade at the end, the flat-



2 SHOT ROUND WIRE TAPESTRY FIG 10

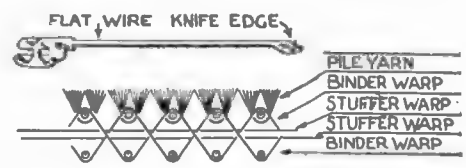
Fig. 10. This shows what a round wire tapestry weave looks like.

tened steel when withdrawn, would cut the surface yarn which would then stand on end and form a plush-effect and would give a Wilton rug. (Fig. 7.) The quality of the Wilton or, in fact, of any rug is governed by the quality of the worsted or woolen yarn, the size and ply of these yarns, the width of the pile wire affecting the height of the pile or the thickness of the rug, the number of frames or yarns used, the pitch or the number of spools provided (for example 256 in a 27″ width), the number of wires to the inch in weaving (13½ in the best quality, 11, 9, or 7 or even less in the lower grades), and whether two or three shots of cotton binding or cross cords are used. The famous Karnak quality, for instance, is a 13½ wire, six frame, 256 pitch, three shot construction. The way in which the average person can tell whether or not he has a rug of good quality as far as its weaving is concerned is to turn the rug over on the back and measure the number of parallel cords to the inch. It will be observed in the photograph (Fig. 5) that there are 13½ wires to the inch in the construction here shown.

It takes 4 to 6 weeks to design a Wilton, 2 weeks to spin, 1 week to make the cards and 4 to 6 weeks to weave the rug.

TAPESTRY AND VELVET RUGS

To contrast Tapestry and Velvet we must understand that each pile yarn is printed in



2 SHOT CUT PILE VELVET FIG.11

Fig. 11. If, instead of using a round wire, we use a flat wire with a cutting knife at the end, we obtain a velvet rug. The nature of the weave is here indicated.

different colors at intervals as desired. The surface yarn carries the pattern and but one beam of yarn is used instead of five or six frames of yarn as in the Wilton. The natural yarn is wound around large drums approximately 31 feet in circumference (Fig. 8). The operator prints colors on this wheel with the aid of analine dyes. He has a small rubber wheel in a little car which runs across the yarn and in front of it and then comes back underneath the drum. We thus have 330 turns of yarn around the drum for

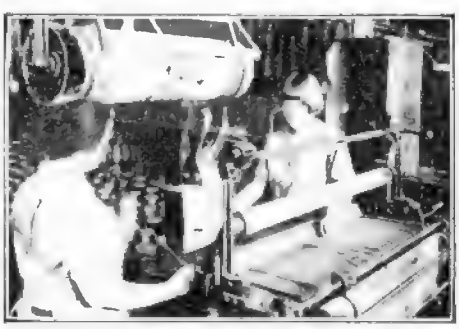


Fig. 12. Here the girls have the pattern arranged on a big spool over their heads and on the setting tables, colored yarns are wound on 27 or 36 inch spools, enough material being put on each spool to weave 150 rugs. These spools are afterwards properly set in place on the Axminster loom.

the 12 feet or lengthwise of the rug weave. This is perhaps 31 feet long, as mentioned before, but will shorten up to 12 feet during the weaving process, or we may have one printed yarn to go right down through 330 rugs. If 400 ends or threads of yarn are needed in the construction for a nine-foot width of weave, it becomes necessary to print 400 drums of yarn. These 400 drums will then make 330 rugs. The dyes are fixed in the wool by steam ovens and the yarns are then set in the proper position on great spools which are placed in back of the looms. (Fig 8A.) Note in this photograph that by the way the spools are set,

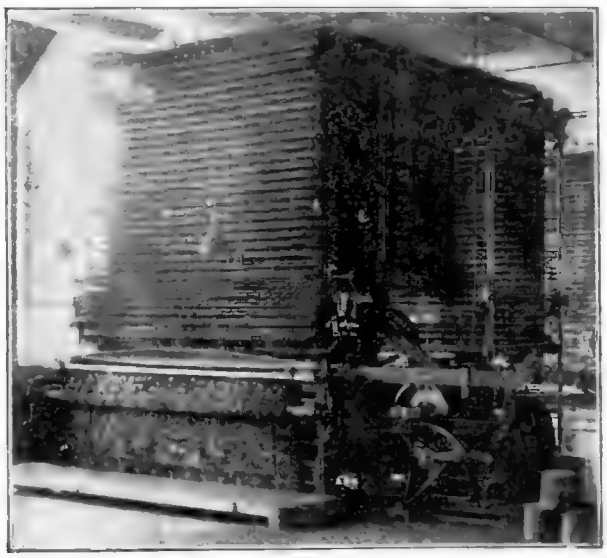
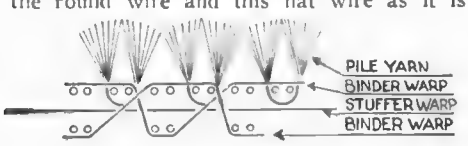


Fig. 13. The Axminster loom in which tubes are delivered frame by frame to the weaving position. The yarn ends are wiped down into the fabric as a 9-foot needle carries a jute yarn across to bind the surface yarn into the fabric.

a fair idea of the pattern can already be obtained, even though the rug itself has not yet been woven. Jute yarn is sized for weight and strength, stained to a neutral tone, and is used to weave into the back forming the warp. When a round pile wire is used in this loom (Fig. 9), leaving an uncut loop of the surface yarn, we obtain a Tapestry round wire (Fig. 10), but when a flat wire with a cutting knife at the end is substituted for the round wire and this flat wire as it is



3 SHOT AXMINISTER FIG.14.

Fig. 14. A comb turns the yarn up into the letter U and cutting knives, 9 feet long, come together, trimming the many ends of surface yarn away from the tube frame.

withdrawn cuts each row of the loops we have a Velvet (Fig. 11).

In body Brussels and Wilton, we always

Fig. 15. In Chenille rugs, two looms are required. The first is the weft loom which weaves a blanket of cloth.

find the buried surface yarn showing through on the back, but in Tapestry and Velvet, all the worsted or woolen yarn is used upon the surface with the cheaper heavy jute yarn forming the back.

AXMINSTER RUG

The moquette or spool Axminster is the representative of quantity pro-

Fig. 17. The cloth is then slit between the warp threads and ironed into a V shape or Chenille cord by the mechanism at the right.

duction in America, its weaving being almost fully automatic and it is comparatively economical in manufacture. Here we find spools of solid colored two- or three-ply woolen yarn arranged on setting tables (Fig. 12), threaded through reeds and wound on 27- or 36-inch spools to a predetermined length and generally enough to weave 150, or some other multiple or rugs. It will be observed that the girls have the pattern arranged on a big spool over their heads. Following this pattern they arrange the colors in the proper order. After they have been properly set, the colored threads are wound upon one long spool in a series of pancakes close to each other. After several weeks of setting, two expert women will have provided from 1200 to 1500 spools 36 inches in width for a good quality 9" × 12" weave. Each spool will have about 504 threads of wool hanging down from it or will have had 512 color combinations or pancakes. The spools are then mounted three

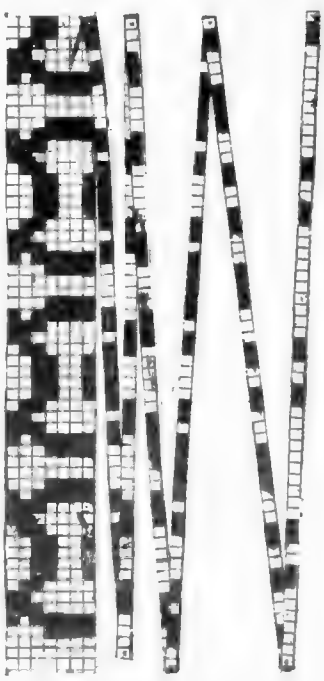


Fig. 16. The weft weaver puts a shuttle or shot of woolen yarn across the loom and back for each square of the design paper which has been cut into strips for this purpose as indicated.

wide on a nine-foot tube frame and then hung in a continuous sprocket chain at the top and back of the Axminster loom (Fig. 13). The tubes are delivered frame by frame to the weaving position. With almost human intelligence, two steel arms take a tube frame and wipe the yarn ends down into the fabric as a nine-foot steel needle carries a jute yarn across to bind the surface yarn into the fabric. A comb turns the yarn up in a letter U and at the same time, cutting knives nine feet wide come together, trimming the many ends of surface yarn away from the tube frame at a set height of the pile (Fig. 14). The tube frame is then restored to the continuous chain.

CHENILLE

In the production of Chenille rugs two

Fig. 18. In the Chenille loom, the operator inserts a piece of Chenille cord and works this clear across the loom with his fingers.

looms are required. The first is called a weft loom (Fig. 15), which weaves a blanket or cloth. A weft weaver puts a shuttle or shot of woolen yarn across the loom and back for each square of the design paper which has been cut into strips for this purpose (Fig. 16). The cloth then takes on a series of parallel stripes of various colors. This cloth is then slit between its warp threads and ironed into a V shape (Fig. 17) or Chenille cord (Chenille translated from the French meaning caterpillar). The Chenille cord coming over the back of the second or rug weaving loom is layed in the open shed in weaving by a traveling finger motion. In other words, you will note in the photograph (Fig. 18), that there is an elongated

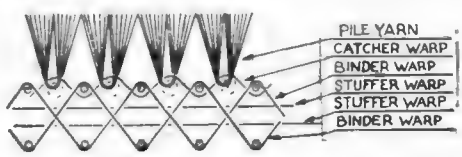


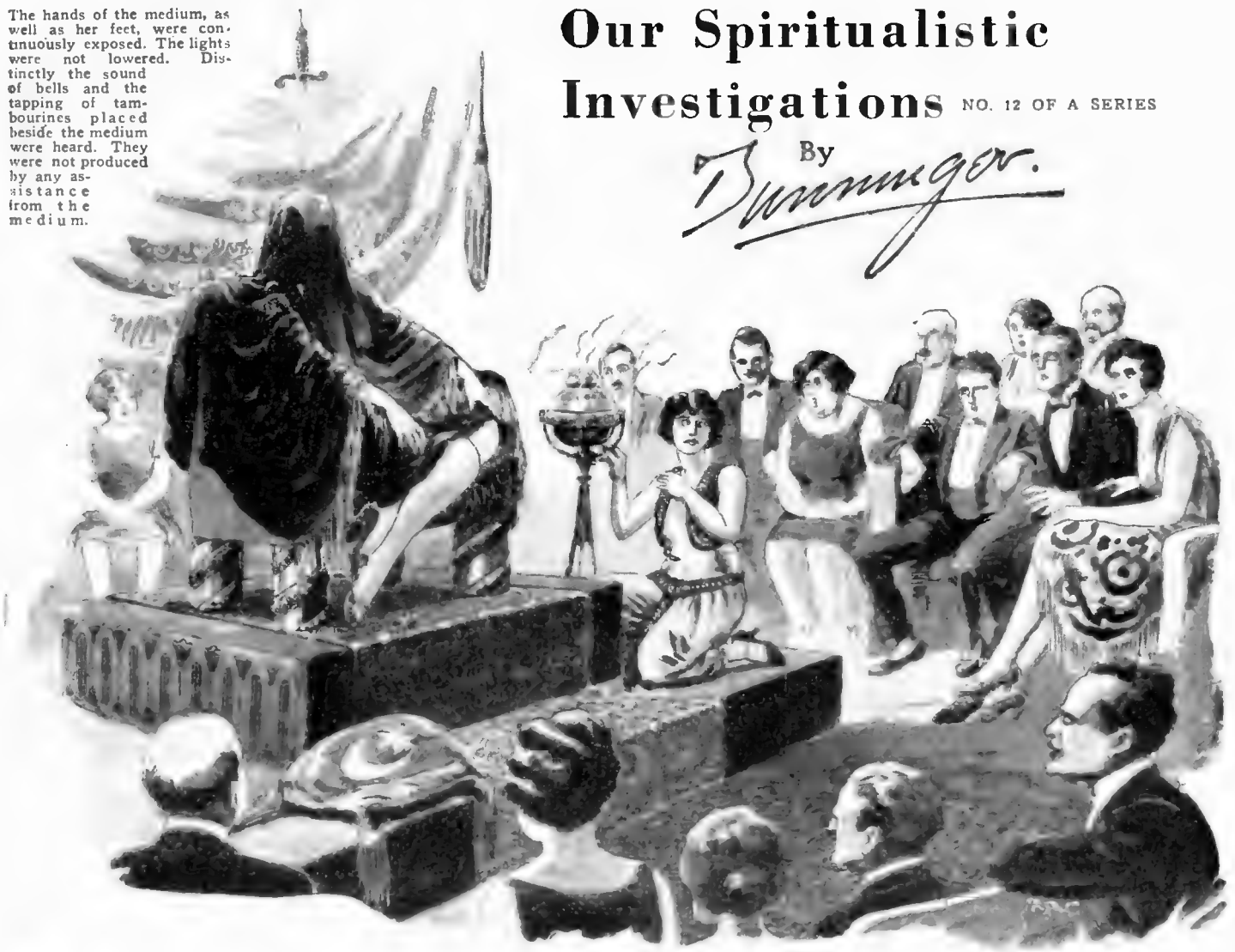
Fig. 19. This shows a cross-section through a Chenille rug.

(*Continued on page 363*)

Our Spiritualistic Investigations

NO. 12 OF A SERIES

By Dunninger.



The hands of the medium, as well as her feet, were continuously exposed. The lights were not lowered. Distinctly the sound of bells and the tapping of tambourines placed beside the medium were heard. They were not produced by any assistance from the medium.

MISS AMELIA BOSWORTH. Psychic and materializing medium. Thus reads a small sign in the window of a quaint, two-story house, located in the outskirts of Portland, Oregon. Miss Bosworth is different. Nothing like anyone whom you have ever seen. Positively genuine, and phenomena most unusual. These very flattering remarks and many others of a similar nature, are in common use by the hundreds of followers this medium has produced. Thus I found myself a visitor at one of the usual séances, conducted by Madam Bosworth.

Her followers consist of the élite, many of whom can be found present at every one of her gatherings. These occur as often as two or three times a week. Her reputation has been broadcasted to so great a degree, that it is a commonly accepted fact that many people travel for miles, to be present at the sittings. I had listened to many conflicting stories, describing this wonder-worker's unusual ability, but as it has been my experience to accept as a general student of psychology, the fact that it is human nature for the average person to exaggerate what they imagine they have witnessed, I was obliged to discount most of the information. But I had gathered sufficient information to arouse my curiosity.

Subconsciously, people will often misrepresent what they imagine having seen, especially in a "spook" parlor, as the imagination plays pranks with many people who have already been subjected to what they believe to be proof of a supernatural demonstration. This medium, a well-to-do widow, in her early thirties, apparently realizes the value of the reputation that precedes her, and accepts a nominal charge of $10 per head, for those who seek a look-in at her sittings. Upon the evening of my visit, I was among some three-dozen, who had assembled in the medium's parlor. This room, unusually large, was decorated in excellent taste, aglow with oriental splendor and figured tapestries galore hung about the walls. Dim lamps, here and there . . . oriental statuary of choice selection stood out in the glow of the dismal lights. Perfume from the East filled the room with a faint vapor, which helped to remind one of an abode in the far off land of India. In the center of the room, in royal splendor, stood a large throne chair, which consisted of a frame-work of highly effective carvings, which had been elegantly upholstered with a high textured plush, of bright, vermilion red.

Directly above this elegant settee, hung a dagger. A dozen chairs or more, all of oriental carving, were assembled around the four walls, between which were thrown heaps of pillows, all in highly tinted colors, many richly embroidered, others lavishly jeweled with brilliant stones, which glittered, afire with splendor.

Miss Bosworth was a tall slender woman, with sparkling black eyes, and a pale complexion, which added much to the mystic picture that she made. She welcomed each and every one of the visitors, individually, and took pains to describe to the curious newcomers, the origin of various bits of pottery, or oriental trinkets, that seemed to arouse their apparent curiosity. A soft, pleasing voice, with a musical ring, enhanced her fascinating personality considerably. Two little Japanese maids hurried in and out from behind silken portieres, serving tea and Japanese dainties to those who cared to partake.

Another young lady, whom the medium called Emma, busied herself in conversation with numerous visitors. This miss, a girl in her early twenties, seemed quite alert, quick witted, and exceptionally shrewd.

After a half hour of social festivities, the

(*Continued on page 371*)

$21,000.00 for Spirits

Dunninger, who writes exclusively for SCIENCE AND INVENTION Magazine and who is the Chairman of our PSYCHICAL INVESTIGATION Committee will personally pay $10,000.00 to any medium or spiritualist who can present any psychical manifestation in so-called spiritualism, that he will not explain or that he cannot reproduce by natural means.

More than two years ago SCIENCE AND INVENTION Magazine offered a prize of $11,000.00 to anyone who could demonstrate his or her ability to communicate with the spirits or to give some definite form of a psychical demonstration which in itself was not trickery.

The result has been that mediums and spiritual organizations have been afraid to place proofs before us. Those weak attempts which have been made to demonstrate psychical phenomena were almost instantly proven fraudulent, and no medium has dared to contradict our findings.

In view of these facts, should we not consider all mediums fraudulent?

To the $10,000.00 which has been offered by Joseph F. Rinn through this publication for Spiritual proofs and the $1,000.00 in addition offered by SCIENCE AND INVENTION Magazine we now add Dunninger's $10,000.00.

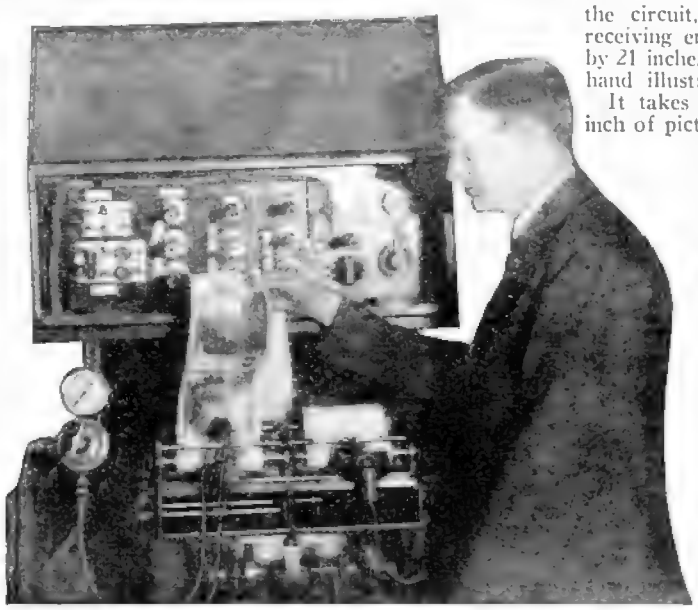
So now we have a total of $21,000.00 offered for proofs of Psychical Manifestations. Spiritualists—get busy.

Radio Picture Machine

Synopsis: In this article the latest radio picture transmission scheme devised by Captain R. H. Ranger is described in considerable detail. The photo or drawing is surveyed line by line, by a beam of light acting on a photo-electric cell at the transmitter. The fluctuating electric currents from the photo-electric cell, corresponding to the variations in light and shade in the photo or drawing, are transmitted by radio or wire, a special machine reproducing or building up the picture line by line at the receiving end. In the very latest radio picture machine here described, Captain Ranger has made it possible to enlarge the picture nine times as it is being reproduced.

CAPTAIN R. H. RANGER demonstrated several years ago that he had perfected an apparatus for the transmission and reception of photographs, line drawings or signatures over a wire or radio circuit. For quite sometime this engineer has had his apparatus set up and in daily operation between important American cities and also between New York and London. The pictures transmitted between New York and London, and which have been supplied to newspapers in both cities, are transmitted and received by radio. The pictures transmitted and received between New York and various American cities are also carried by radio waves.

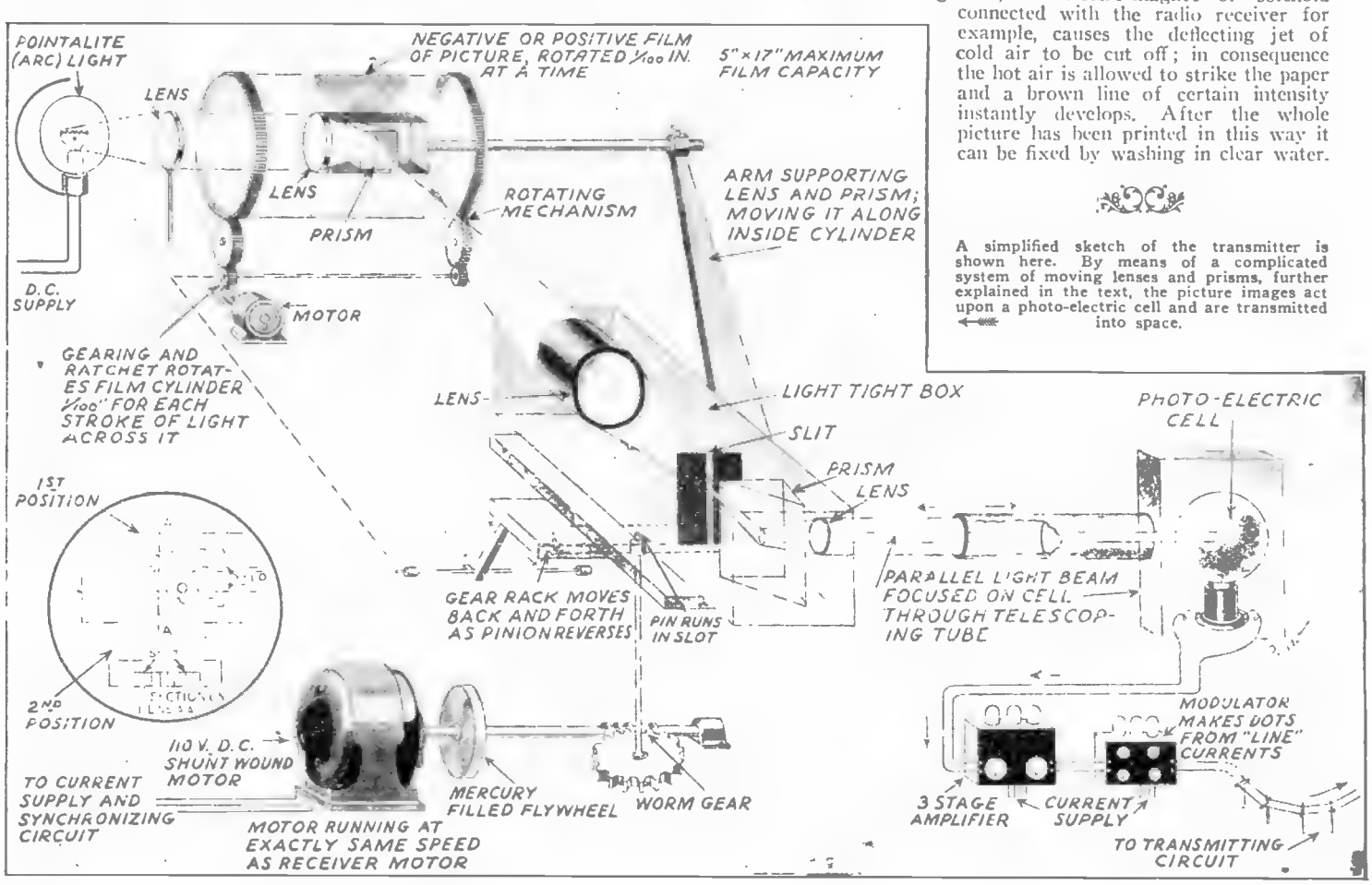
The photo below shows Captain Ranger examining photos reproduced on one of his smaller machines, that is, a machine which reproduces a photograph measuring say 5 by 7 inches, the same size as the photo transmitted. His latest achievement, which has received considerable mention in the public press recently, is a highly improved and ingeniously constructed photo reproducing machine, which enlarges the image nine times, i.e., if a 5 by 7 inch photo is placed on the transmitting machine at one end of the circuit, the picture reproduced at the receiving end of the circuit will measure 15 by 21 inches, as the picture at the lower right hand illustration shows.



A view of Capt. R. H. Ranger's first radio picture machines. With this apparatus it was possible to make two pictures simultaneously but they were of the same size as the picture used at the transmitting end.

It takes about ten minutes for each one inch of picture transmitted or received. Thus if a picture measures 7 inches long, it will take seven times ten, or seventy minutes to reproduce the picture, once the apparatus has been synchronized and started tracing the picture.

Captain Ranger's first machines employed for transmitting pictures, both over land wire circuits and by radio across the ocean from England, employed a specially prepared wax ink. It is very interesting to note at the outset, that in his newly perfected *image enlarging* reproducer, no ink of any kind is used directly; nothing but a jet of hot air. This jet of hot air, as will be seen in the lower right hand illustration, impinges on a chemically treated paper, which unreels from a roll in a progressive and systematic manner line by line. Where the hot air strikes the paper, a remarkable chemical change takes place and a brown tint instantly appears. When an incoming signal arrives from the machine at the transmitting end, an electro-magnet or solenoid connected with the radio receiver for example, causes the deflecting jet of cold air to be cut off; in consequence the hot air is allowed to strike the paper and a brown line of certain intensity instantly develops. After the whole picture has been printed in this way it can be fixed by washing in clear water.


POINTALITE (ARC) LIGHT
NEGATIVE OR POSITIVE FILM OF PICTURE, ROTATED 1/100 IN. AT A TIME
5" x 17" MAXIMUM FILM CAPACITY
LENS
LENS
PRISM
ROTATING MECHANISM
ARM SUPPORTING LENS AND PRISM; MOVING IT ALONG INSIDE CYLINDER
D.C. SUPPLY
MOTOR
GEARING AND RATCHET ROTATES FILM CYLINDER 1/100" FOR EACH STROKE OF LIGHT ACROSS IT
LENS
LIGHT TIGHT BOX
SLIT
PRISM
LENS
PHOTO-ELECTRIC CELL
1ST POSITION
2ND POSITION
GEAR RACK MOVES BACK AND FORTH AS PINION REVERSES
PIN RUNS IN SLOT
PARALLEL LIGHT BEAM FOCUSED ON CELL THROUGH TELESCOPING TUBE
110 V. D.C. SHUNT WOUND MOTOR
TO CURRENT SUPPLY AND SYNCHRONIZING CIRCUIT
MERCURY FILLED FLYWHEEL
WORM GEAR
MOTOR RUNNING AT EXACTLY SAME SPEED AS RECEIVER MOTOR
MODULATOR MAKES DOTS FROM "LINE" CURRENTS
3 STAGE AMPLIFIER
CURRENT SUPPLY
TO TRANSMITTING CIRCUIT

A simplified sketch of the transmitter is shown here. By means of a complicated system of moving lenses and prisms, further explained in the text, the picture images act upon a photo-electric cell and are transmitted into space.

Enlarges Image Received

It will be understood of course that the picture transmission receiving system in question is a progressive line by line process, i.e., the picture is analyzed and rebuilt in lines or sections.

HOW THE PICTURE IS TRANSMITTED

To get a clear idea as to just how the picture is transmitted, let us look at the special illustration at the bottom of the left hand page. Here we see that a negative photo film, containing the image of a face for instance, is placed around a glass cylinder. A powerful beam of light from a pointalite (incandescent-arc lamp) lamp passes through two lenses, thence through a prism, and is brought to a focus on the film itself. The beam of light then passes into a moving lens and prism system, and eventually passes through a correcting lens in the form of a parallel beam of light, and impinges upon a photo-electric cell of the potassium type. In the center of the illustration will be seen the gear and rack arrangement which very cleverly traverses the carriage containing the central lens-prism system, together with its extending arm carrying the prism and lens system, back and forth inside the glass cylinder around which the negative is secured.

Of course it at once becomes evident that the electric motors at the transmitting and receiving ends of the wire circuit or radio system, will have to rotate at constant and similar speeds. More will be said concerning these motors a little later.

Looking at the glass cylinder of the transmitting machine for a moment, let us see what happens each time the traveling lens and prism systems move back and forth. Each time the lenses and prisms are moved across the picture, the glass cylinder is rotated one one-hundredth of an inch. It will be seen that as the light beam passing through the negative, and moving across it from left to right or right to left, encountering the various lights and shadows, that the beam of light transmitted through and beyond the film to the second lens-prism system, will be varied in intensity in exact accordance with the lights and shadows on the film negative. In passing it is interesting to note that by a simple electrical control, a positive film can at once be used, if that happens to be the only one available, the proper compensation for the reversal in light values being taken care of by the change in the circuit aforementioned.

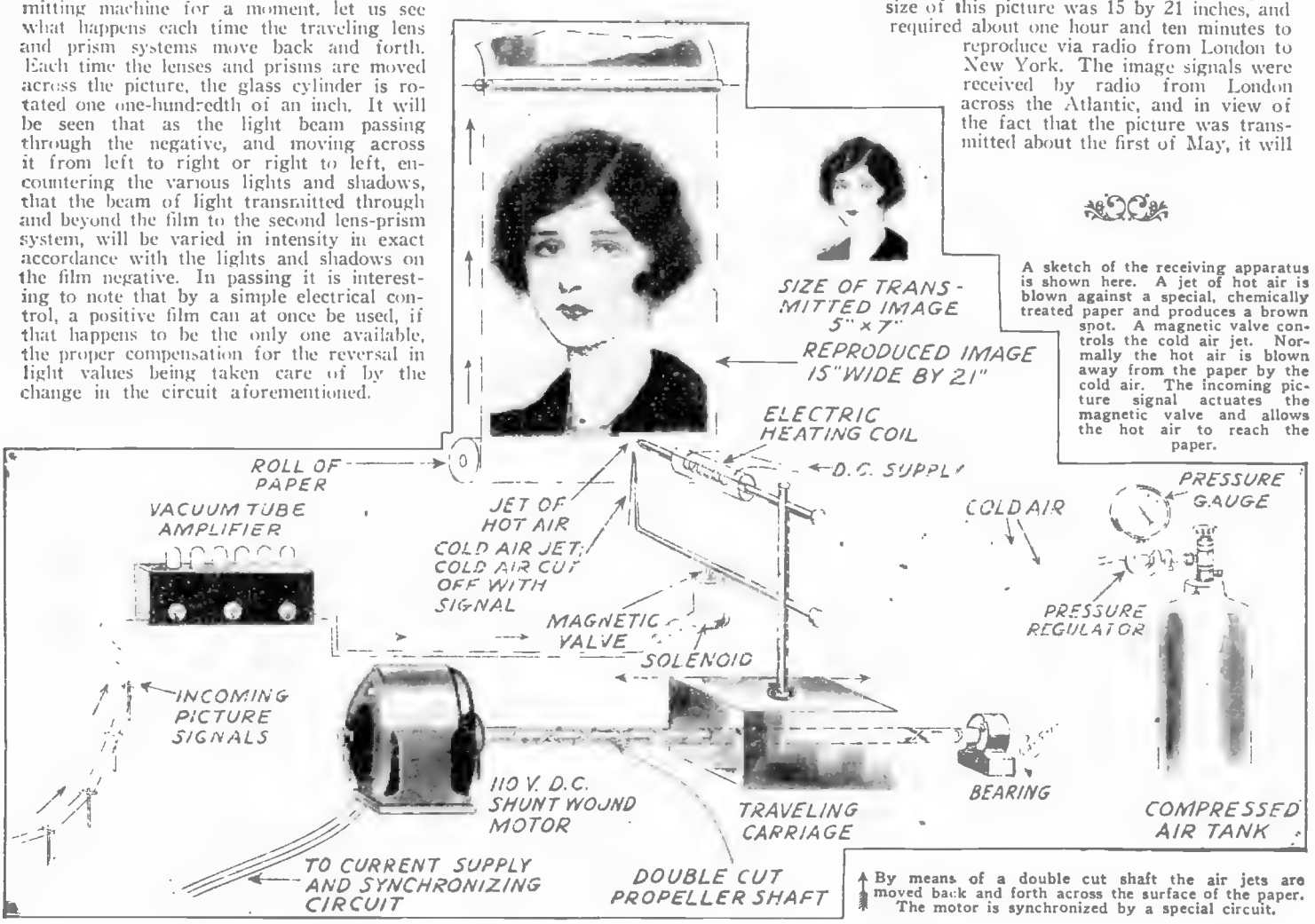
The fluctuating or varying light impressions carried through the lens and prism system, and thrown on to the photo-electric cell in its light-tight metal housing, cause corresponding fluctuations in an electric circuit connected with the photo-electric cell. These fluctuating currents from this light-sensitive cell are amplified considerably, and in order to break up the picture image currents into dots, a highly ingenious and somewhat complicated vacuum tube modulator is connected into the circuit, as shown in the left hand illustration.

Thus we find that a series of dots or rather electrical signals corresponding to dots, pass over the wire circuit to a vacuum tube amplifier at the receiving end of the line. Glancing now at the large picture, showing the photo being reproduced at the receiving instrument, we note that a synchronous motor of special design traverses a carriage back and forth before a sheet of paper, which is correctly and progressively advanced three-hundredths of an inch, each time the hot air brush *paints* a brown spot of suitable tint on the paper. As aforementioned, whenever an incoming dot signal arrives, it is suitably amplified and causes the magnetically controlled cold air valve to operate, which in turn allows the hot air jet to strike the paper and causes a brown impression to be made.

By referring to the diagram on the third page of this article, one will gain a somewhat clear idea as to how the various tones are transmitted and received. In this diagram there is an auxiliary picture showing the dot line code invented by Captain Ranger and his associates for using this method of picture transmission. It will be seen that the dots are of equal width but of varying length, and also that the dots are longer and closer together as the tones grow darker, and vice versa.

As the pencil of hot air is propelled across the paper, first to the right and then to the left progressively, and the paper is advanced correspondingly, the width of a line each time, it will be evident how the picture is eventually reconstructed or built up.

The reason why the picture enlarging process just perfected by Captain Ranger is desirable from the newspaper and magazine point of view, is due to the fact that the picture has certain irregularities in it due to the dot process by which it is built up or reconstructed at the receiving end of the circuit. If this picture is as big as 15 by 21 inches instead of 5 by 7, it can be photographed down when making a cut for a newspaper or magazine, and in so doing the detail and slight irregularities in the dot construction are made much smaller, and the final reproduction in the reduced cut is practically as perfect as the image on the original photo negative used at the transmitter. The picture of Captain Alexander Collie shown on the third page of this article, together with a view of the new picture enlarging reproducing machine, gives the reader an idea as to just what this machine can do; especially so if you view this picture of Captain Collie at arm's length. The original size of this picture was 15 by 21 inches, and required about one hour and ten minutes to reproduce via radio from London to New York. The image signals were received by radio from London across the Atlantic, and in view of the fact that the picture was transmitted about the first of May, it will



A sketch of the receiving apparatus is shown here. A jet of hot air is blown against a special, chemically treated paper and produces a brown spot. A magnetic valve controls the cold air jet. Normally the hot air is blown away from the paper by the cold air. The incoming picture signal actuates the magnetic valve and allows the hot air to reach the paper.

By means of a double cut shaft the air jets are moved back and forth across the surface of the paper. The motor is synchronized by a special circuit.

Radio Photos Enlarged When Received

(Continued)

At the left is a photograph of Capt. Alexander Collie which was transmitted across the ocean by means of the new radio picture machine. Note the fine quality of the picture.

Below we have a view of the new radio picture machine which not only reproduces the picture at the transmitter, but also enlarges it to nine times the size of the original transmitted image.

be seen that the static or interference of any kind did not have any noticeable effect on the reproduced picture.

HOW SYNCHRONISM IS ESTABLISHED

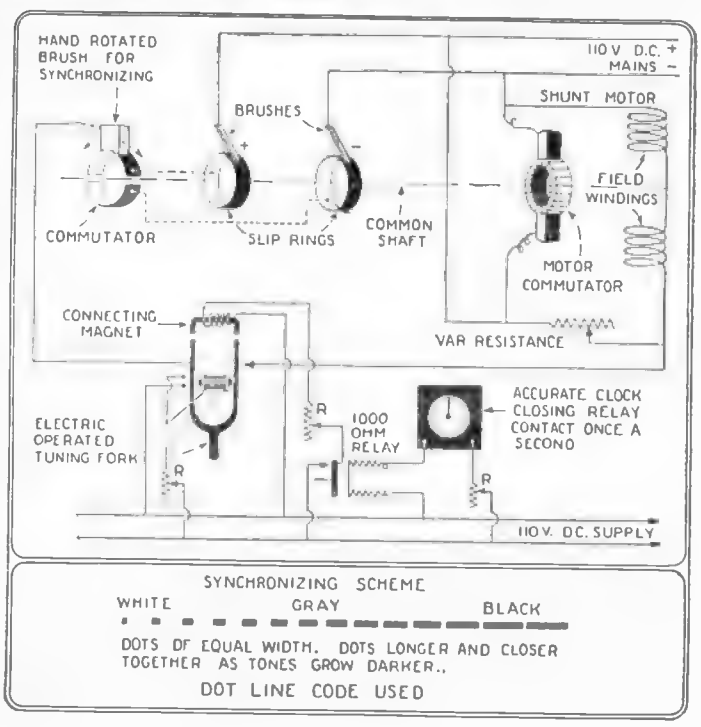
Strange as it may seem, ordinary 110-volt direct current shunt wound motors were used both at the transmitting and receiving ends of the circuit, instead of the usual alternating current synchronous motors. The direct current motor is carefully checked many times per minute by means of a tuning fork and clock system shown in the diagram herewith. The direct current motor of standard make, and having a shunt wound field, is provided with a variable resistance in series with this field winding for one thing. Secondly, on the same shaft with the commutator and armature of the motor, there are placed two slip rings to make contact with the usual stationary brushes, and also two commutator segments and a movable *synchronizing* brush. Next we find the wire from this synchronizing brush connects to either a contact or the frame of a large tuning fork which is electrically vibrated with a magnet in the manner shown in the diagram, the fork being placed in an air-tight cabinet provided with automatic thermostatic means for keeping the temperature within the cabinet constant. Otherwise temperature changes would cause the fork to vibrate at a slightly different frequency and throw the system out of frequency with the machine at the end of the line. As will be seen, this system is extremely clever, as all that Captain Ranger requires is a two-wire circuit or a single radio wave over which to transmit the simple dot impulses, and he requires no synchronizing channel at all. Each motor is synchronized at its own particular station by the tuning fork and clock shown in the diagram herewith. The clock is a very accurate one, such as built for ship use. The tuning fork has a frequency of seventy vibrations per second, and the correcting magnet placed at the head of the fork receives an impulse by means of the 1000-ohm relay and a contact inside the standard clock once every second.

The synchronizing impulses operate in the following manner. At a given instant if the auxiliary or shunt circuit from the 110-volt D. C. mains through the slip rings and brushes, thence through the synchronizing brush and commutator, on through the tuning fork, is closed; then if the fork is closed at this instant and a positive impulse passes to the field winding connection, the series field resistance will be short-circuited, and the motor will momentarily decrease in speed as the field has been strengthened. If at the next instant the armature shaft and commutator segments have turned half a revolution, and providing the fork contact is closed at that instant, and a negative impulse passes to the common field-resistance connection, the field winding will be short-circuited for a fraction of a second; the resultant magnetic field in the motor will be weakened, and in consequence the armature speed will increase.

Thus the armature of the motor is increased and decreased in speed many times a second, and the mean average resultant speed is as constant as could be desired. In order to know when the motor is in synchronism with the master tuning fork and clock, a small neon tube is mounted crosswise on the end of the motor shaft, and it is supplied with a pulse of current from the 110-volt D. C. line through a set of auxiliary contacts, operated by the tuning fork at each vibration of the fork. A stroboscopic action takes place when looking at this neon tube mounted on the end of the motor shaft, with the result that when the motor is running at perfectly synchronous speed, as determined by the tuning fork and clock, the neon tube can be seen clearly just as if it were standing still. If the motor is below or above synchronous speed, the neon tube will be seen to rotate either backward or frontward, as the case may be.

The transmission of pictures over the air had been a subject of much speculation and experimentation, until the process had been perfected to such an extent to make the transmission practical. The first pictures transmitted were crude but they served to spur the workers on and encourage them to continue with their labors. Captain Ranger's first radio picture apparatus received two pictures of the original transmitted image simultaneously. His latest invention, however, not only receives the picture but also enlarges it to nine times the size of the original.

At the right is a sketch of the synchronizing circuit. A large tuning fork is used which is made to vibrate by means of an electro-magnet. A small neon tube is affixed to the end of the motor shaft and serves as a signal to the operator, who can tell when the motor is in synchronism. The positive impulses cause the motor to slow down, that is, if the tuning fork happens to be making contact at that particular instant; while the negative impulses cause the motor to increase in speed.



MOTOR HINTS

Conducted by GEORGE A. LUERS

DO YOU KNOW—

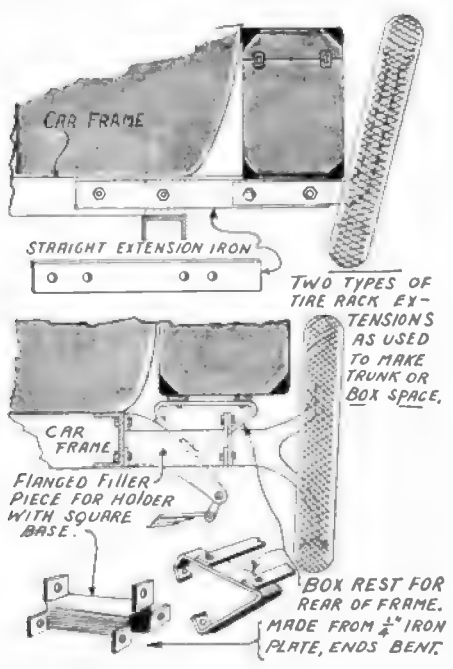
babbitt bearings seldom loosen except from lack of oil or from high speed? Particles of metal in the oil become embedded in the babbitt without occasioning wear, and for this reason it is better than ball or roller bearings.

TRUNK SPACE CAN BE MADE AT THE SPARE TIRE

The trunk or the storage box, provides means for carrying many of the essentials for a tour or week-end run. Many of the newer models of cars have provision on the rear of the car, between the tire rack and the body for the trunk or box. Cars not of this type, can be altered slightly to make room for the same, which change is readily accomplished by the owner.

Two methods are here shown, which are of use on two types of cars. Modifications of these methods, will easily suggest themselves, for cars with different supports for the tire rack.

When the tire rack is supported with two arms from the rear end of the frame, have a blacksmith or machinist make two extensions, with bolt holes positioned to provide for the width of the trunk to be carried. Two cross-pieces made of one-quarter inch by one and one-half inch iron, provide the seat for the trunk.


CAR FRAME
STRAIGHT EXTENSION IRON
TWO TYPES OF TIRE RACK EXTENSIONS AS USED TO MAKE TRUNK OR BOX SPACE.
CAR FRAME
FLANGED FILLER PIECE FOR HOLDER WITH SQUARE BASE.
BOX REST FOR REAR OF FRAME.
MADE FROM ¼" IRON PLATE, ENDS BENT.

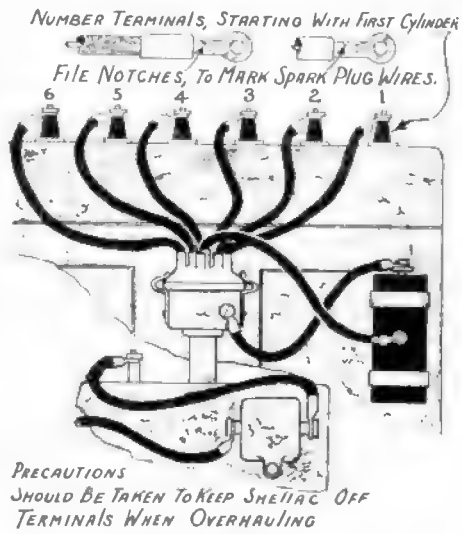
A rear trunk on a car is a very handy thing. Two methods of adapting cars not already so equipped, are shown above.

When the holder is supported on a square base, have an extension base or filler made, with the flanges as shown in the sketch. This is easily forged from a piece of one-quarter inch iron plate. Box seats are made from one-quarter inch iron, to rest on the frame extension.

CROSSED WIRES AND SHELLAC ON TERMINALS CAUSE TROUBLE

The spark plug wires look so much alike, that it is very probable these will be crossed after taking off the engine head for repairs.

With a six cylinder engine, this is difficult to trace, as the engine may be run on the other four cylinders, while the spark at the crossed wires will be strong and apparently right. A check on the firing order will of course prove that the wires are crossed.

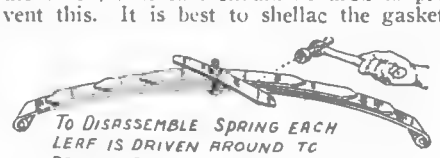

NUMBER TERMINALS, STARTING WITH FIRST CYLINDER
FILE NOTCHES, TO MARK SPARK PLUG WIRES.
6 5 4 3 2 1
PRECAUTIONS SHOULD BE TAKEN TO KEEP SHELLAC OFF TERMINALS WHEN OVERHAULING

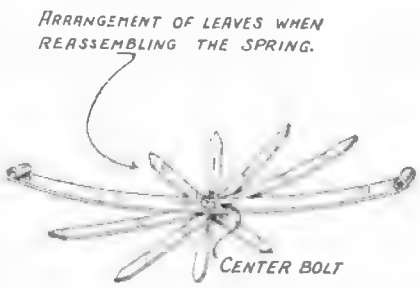
By notching the terminal lugs with the cylinder number, the chances of replacing the lugs on the wrong spark plugs are made negligible.

To prevent wires being crossed easily, small notches in the terminal, as shown in the illustration, will prove simple and effective.

These notches are made with a file, and they are notched to correspond to the cylinders, that is, one for first cylinder, two for second cylinder, and so on to the rear.

Along with engine repairs, comes the use of shellac. When the shellac brush touches a connector or terminal, it deposits an effective insulation. The low tension current will not pass through the shellac and sometimes it will interfere with the high tension current. It is so easy to drop the shellac on the terminals when laying down the brush, that care should be used to prevent this. It is best to shellac the gaskets on the bench, and go over the connections with alcohol and a rag, before replacing them.





The leaves of automobile springs may be more easily removed for replacement if the tension is removed by hammering them around, as shown in the above illustration.

WHEN REPLACING A BROKEN SPRING LEAF

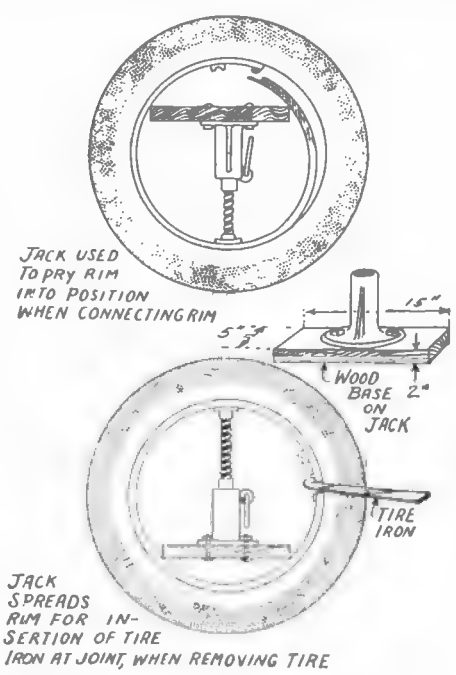
This method consists in placing the spring on the floor or bench, removing the clips and leaving the center bolt in place. With taps of a hammer, the top leaf is turned enough to bring it slightly off the under leaf. A bar of iron held against the spring and the hammer blows applied to the end of this bar will be found good technique. Each leaf is then turned in the same manner.

When all leaves are turned, the center bolt is loose.

To reassemble, the reverse method is used, placing the leaves in diagonal positions, putting in the center bolt and finally straightening them up with the hammer. This method will save a lot of hard work and skinned knuckles also.

THE JACK WILL HANDLE STUBBORN TIRE RIMS

Hot weather repairs include the changing of tires, and this one item may constitute the major part of the work, if much driving is done.


JACK USED TO PRY RIM INTO POSITION WHEN CONNECTING RIM
15"
5"
WOOD BASE 2" ON JACK
TIRE IRON
JACK SPREADS RIM FOR INSERTION OF TIRE IRON AT JOINT, WHEN REMOVING TIRE

The jack becomes a handy tire tool when properly mounted.

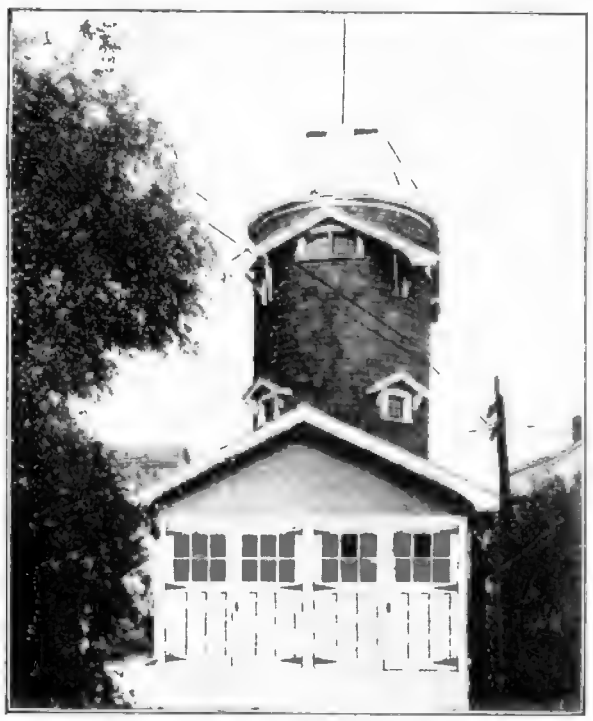
Brute force is one of the essentials to tire changing, as the tool equipment is limited to two irons and a hammer, unless the facilities of a service station are available, or a regular rim expanding tool is included in the tool equipment.

One of the best aids to changing the tire, is through use of a jack, with an extension base as shown in the attached drawing. This provides means to start the rim open for insertion of a tire iron when breaking it down, and also the means for prying the rim open when making the joint connection.

A piece of oak, fifteen inches long, five inches wide and one inch thick, is bolted to the jack base, with two small stove bolts.

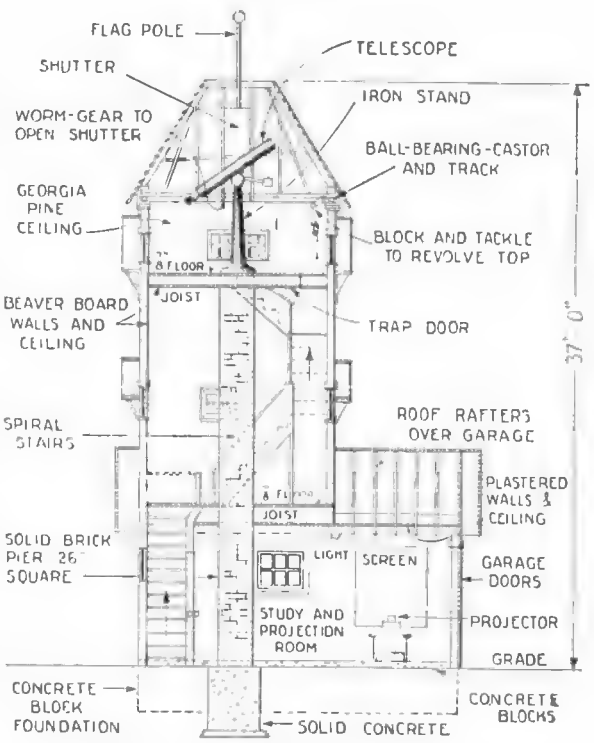
Star Gazing Is My Hobby

By DR. CHARLES W. BULLOCK



A sectional view of the silo astronomical observatory is shown at the right. The total height of the building from the ground to the top of the dome is 37 feet, and to the top of the flag pole, 45 feet. This unique observatory is well equipped with an equatorially mounted telescope, text books, sky maps and charts.

A photo of the observatory and the garage may be seen at the left. The garage has been converted into a microscopical laboratory and contains the most up-to-date equipment and conveniences. Both buildings rest upon a strong foundation of block concrete and are attractively painted a lemon yellow with white trimmings.



TO begin with, I may say that this is the only private, active Observatory in this section of the Lake Erie southern shore. The structure was designed the latter part of April of last year, actual building operations were started in the early part of May and the entire structure was completed on July 14th.

The Observatory is located in the rear of my home at 23 Winston Road, Buffalo, and occupies a commanding position in the neighborhood.

The lower part of the building is in the form of a two-car garage with the observatory tower rising from its roof. Because of the peculiar tower-like construction, the residents of Buffalo and especially those living in our vicinity in the North Central Park section of the city could not understand what such a building might be used for. While the lower part was in course of construction, the people thought that I was building a garage and let it go at that; but when the construction of the tower began, the entire community was thrown into a fever of curiosity and excitement.

The most ridiculous of all surmises was that I was building a *silo;* that I was experimenting with a herd of cattle and a flock of chickens and that the silo would contain the food supply for my animals. Where in the world I would keep this zoo or menagerie while carrying on these experiments (whatever they might be) is more than I can imagine. So far as I know I have no miraculous powers to stretch a 40x130 foot lot into a ten acre farm, to say nothing about barns and chicken coops.

And last, but by no means least, I was accused of building a *distillery.* The party who had that brilliant and enlightening idea said that, being a chemist, I could easily make the "stuff" and that it would undoubtedly be pure and safe to use. When I heard this bit of information, I gave out a statement to the effect that if I were going into the bootlegging business I certainly would not advertise the fact by raising a tower up into the air, but rather, would dig a tunnel beneath the surface of the earth and carry on my illicit operations in concealment. Evidently this party did not know me, or if he did, my reputation as a law-abiding citizen has been eternally blasted.

On June 29th, of last year, there was an article in the *Buffalo Evening News* under the title "Mystery Building 'Rouses Curiosity; Silo is Astronomical Observatory." This item fully explained the building and the uses to which it is put. After reading the write-up, our neighbors' curiosity was satisfied; the excitement died a natural death and the community settled back again into its ordinary round of every day life and existence.

And now a few facts as to the structure itself:

The total height of the building from the ground to the top of the dome is 37 feet, and to the top of the flagpole, 45 feet. It rests on a solid concrete foundation which insures its safety and stability. The "garage" is completely furnished and has been converted into a microscopical study, equipped with the most modern and powerful projecting microscope yet devised. This room is 18x20 feet in size, and the ceiling is 10 feet high. A stairway leads straight up from the ground floor to the floor above the microscopical room, and from that point it is semi-circular up to the observatory proper. The number of steps in the stairs is thirty-six.

The observatory is 11½ feet in diameter (inside measurement), the wall from the floor to the base of the dome, 4 feet 2 inches high, and the total height from the floor to the top of the dome, 11 feet 8 inches, the dome proper being 7½ feet in height. The dome is of galvanized iron, weighs 1,620 pounds, revolves on a circular iron track, and rests on twenty steel ball-bearing rollers; it is moved by two pulley arrangements; a sliding panel is provided for observation which makes it convenient for the observer who is thus always under shelter. The dome can be completely revolved, the panel opened and the telescope pointed to any part of the heavens, from the zenith to the horizon and to every point of the compass; the same principle being carried out here as is used in the larger astronomical observatories.

The pier on which the telescope rests is of solid concrete and brick. It extends to five feet below the surface and reaches hard pan. This five feet is of concrete, three feet square, and from the top of the surface it is of solid brick, two feet square. It is separate from and independent of the structure proper.

The interior of the building is nicely finished and no expense was spared to make it modern and convenient in every respect. It is electrically wired for light, heat and the manipulation of the microscope, and is also piped for gas; an electric burglar alarm system is installed as a precaution against theft. The observatory is supplied with a full set of sky maps, charts, star and planet finders, and the leading amateur text books on the science of Astronomy. The building is painted a lemon yellow with trimmings of white and the dome is coated with aluminum paint. It is of stucco and wood material and the highest structure in our vicinity. The color combination is very pleasing and with the Stars and Stripes flying from the flagpole, it presents a unique picture.

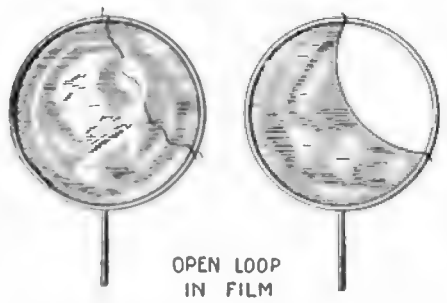
The telescope is the only equatorially mounted instrument in this section. It is equipped with a battery of ten eye-pieces ranging in power from thirty to four hundred diameters; zenith prism, Herschel solar prism and absorbing wedge; sun glass; ray filter; telescopic projection apparatus; erecting system. The tube is 66 inches long, made of solid brass and covered with a white satin finish, and the objective has a diameter of 102 millimeters (about 4 inches); the total weight of the instrument with clamp, circles, scale, clock, mounting and base is in the neighborhood of three hundred and twenty pounds.

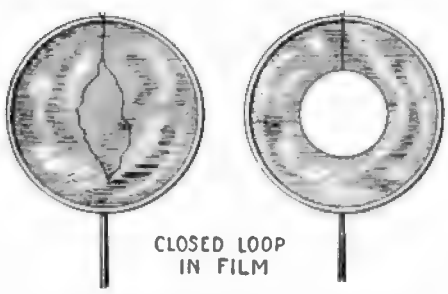
In conclusion I wish to state that I am no astronomer; I am an analytical chemist and have taken up the study of astronomy as a hobby and for the pleasure derived from it. To me it opens a field of investigation and exploration and brings man nearer to his God and Creator.

Odds and Ends of Physics

By T. O'CONOR SLOANE, PH.D.

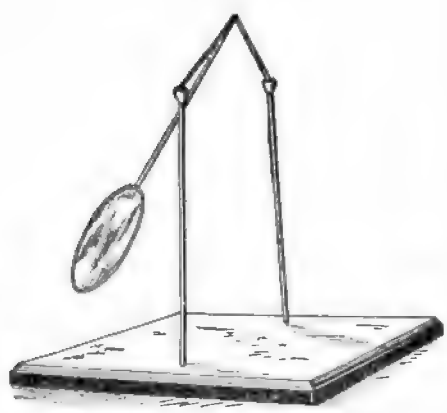
ELASTICITY OF A SOAP BUBBLE FILM





A circular frame of wire about an inch and a half wide has secured to it a loose thread as shown. Now if the film is broken by touching it with a hot bit of wire on one side of the thread, the film will shrink instantly like a sheet of India rubber and draw the thread into the arc of a circle. Another way of demonstrating this elasticity, is to have a little loop of thread as shown in the lower illustration. This is dipped into the solution and picked up in the loop. On breaking the film inside the thread by touching it with a hot wire, the loop is drawn out to a perfect circle.

THE PENDULUM



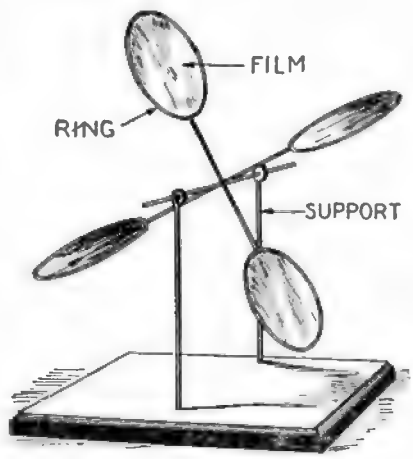
A pendulum is made of wire with a circle at the end. This will swing rapidly back and forth. Now dip it into the solution and the film will fill the loop, and if it is started swinging, it will move very much more slowly on account of the resistance offered by the film. If the loop now is turned so as to be in the plane of oscillation, it will go rather faster with the film in it than without it.

Referring to the thread loops as described above they can be used in the pendulum so as to modify its rate of oscillation by the film being punctured and broken so as to reduce the area left. This experiment shows the strength of the film.

MAKING A HOLE IN SOAP BUBBLES

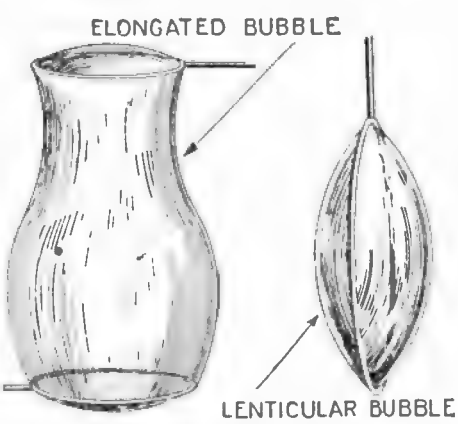
A soap bubble is blown and the end of the pipe is plugged up with a bit of bread crumb or the finger may be held over it. A loop of wet thread, which must be very small, is dropped upon the bubble, and is touched with a hot wire. This breaks the film within it, making a little circular hole, and the air within the bubble escapes from it and the bubble shrinks away and disappears. A film across the mouth of the pipe will be left with the hole preserved.

SOAP BUBBLE WINDMILL



A little windmill can be built of wire as shown. It must be carefully balanced and this is the troublesome part. The four rings are dipped into the soap bubble solution and the little mill can be made to turn by blowing against the upper or the lower film. A mailing tube is a good thing to use to direct the air currents.

CURIOUS BUBBLES

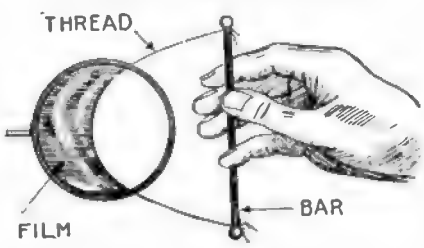


A soap bubble can be carried on one of the wire loops and if a second one is touched to it, it can be drawn out into a most curious shape. These wire loops must be absolutely complete and have no opening and must be wet with the solution before use. If a bubble is picked up on the loop, the air can be withdrawn by a pipe stem being inserted until it takes the form of a lens as shown, and one or both ends of the elongated bubble can be broken so as to give a cylindroid.

BLOWING ONE BUBBLE INSIDE ANOTHER

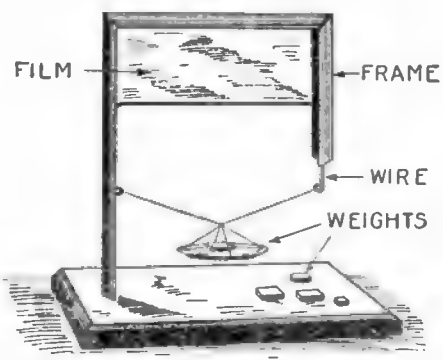
By holding a bubble suspended on a wire loop a second bubble can be blown inside it, with a tobacco pipe as shown.

STRETCHING THE FILM



The ends of a thread are attached to a bit of wire or a stick forming a loop, and the loop is laid across a frame filled with film, and by a little careful manipulation the film is broken on one side of the thread. The loop can now be pulled to and fro stretching and releasing the film over and over again. It can even be allowed to attach itself to the wire the film disappearing and then the film can be drawn out so as to completely fill the loop, and the thread can be pulled completely away, leaving the loop of wire once more completely filled with film.

STRETCHING THE FILM MECHANICALLY

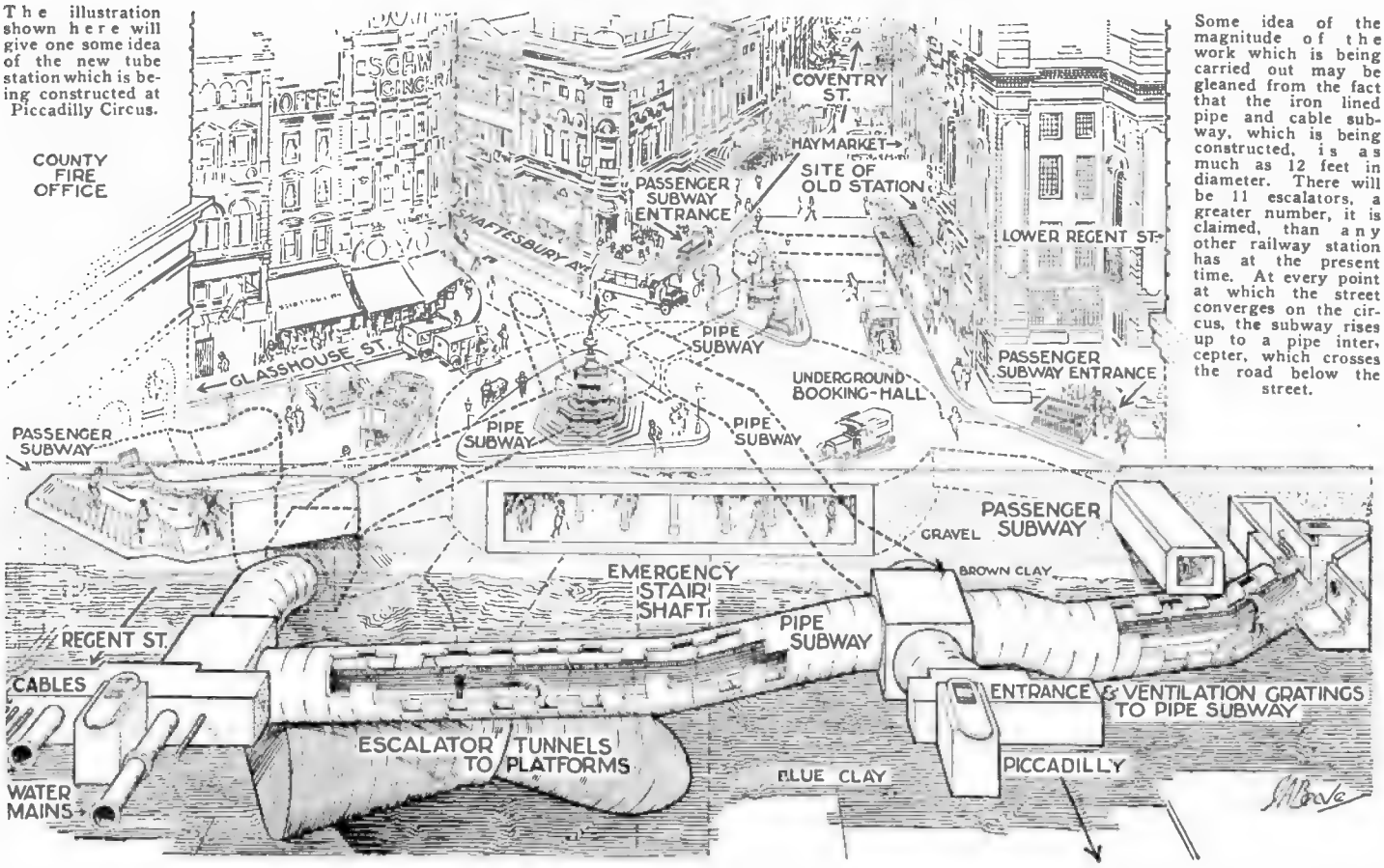


Here we have an interesting variation on the experiment just shown. A frame is made of doubled tin within which a wire bent so as to form three sides of a rectangle can move very freely. If this is filled with film it will draw the wire up tightly against the top and the wire can be drawn down pulling film out with it, and by tying a thread across the ends of the wire with a little pan, weights may be used to draw out the film to see how hard it pulls. The soap solution for all these experiments is made from white castile soap, one part of soap to forty parts of rain water or distilled water. To three-parts of this solution by volume, two parts of chemically pure glycerine may be added. The glycerine makes the solution last better.

London's New Underground Maze

Piccadilly Circus Is to Have a Pipe and Cable Subway

The illustration shown here will give one some idea of the new tube station which is being constructed at Piccadilly Circus.



Some idea of the magnitude of the work which is being carried out may be gleaned from the fact that the iron lined pipe and cable subway, which is being constructed, is as much as 12 feet in diameter. There will be 11 escalators, a greater number, it is claimed, than any other railway station has at the present time. At every point at which the street converges on the circus, the subway rises up to a pipe intercepter, which crosses the road below the street.

The Astrology Humbug

By JOSEPH H. KRAUS

Further Letters From Our Readers and Our Answers

BELLE BART'S ASTROLOGY

Editor, SCIENCE AND INVENTION:

I have been following with interest your articles in regard to the "Astrology Humbug" and I want to say that I thoroughly agree with your sentiments in regard to it. I enclose an article which I found in the Boston Sunday American for December 24, and which may be of interest to you, if you have not seen it. Possibly the same section appears in some of the New York dailies.

At any rate, I shall keep a record of the prophesies which Miss Bart gives, and shall endeavor to see which of them comes to pass. Of course, on the face of the matter, it is hardly likely that at least some of them must come true. They are facts that almost anyone could predict with reasonable certainty. That the Prince of Wales should be severely hurt from one of his horses is sure to happen some day, and very likely will happen within the next twelve months. John D. Rockefeller, at no time within the past few years enjoying perfect health, and now probably quite weak in constitution, almost *should* have some serious illness. Thomas Edison, at all times working on dangerous experiments, falls far within the circle of probable serious accident. And that Wall Street should take a flop during 1927 is a fact that needs no astrologer to figure out. Few have been the years when some catastrophe did not take place in this avenue of brokers.

Astrology is not a humbug, it is not a fraud, it is not a pseudo-science—it is absolute idiocy. There is no place, there can be no place in science for astrology. The very scientific construction of the universe does not admit of any astrological distribution of the stars. Furthermore, while true science teaches us how infinitely small and unimportant the genus homo really is, astrology has the audacity and the crass egotism to attempt to teach us that the very stars, millions of light years away in the depths of space, are moving in co-ordination with the movements of our Earth and our universe so that these stupid ignoramuses can read the fate of individual humans!

If such were the case—if Man were the highest power in the entire universe of the stars—if the stars were made to order for his individual fates—if everything in the heavens takes place, simply because Man down below looks upward for his life history—would we be living in comparative discomfort on our little globe? Why would we not be supreme beings, traveling at will through the depths of space—choosing for our abodes planets of larger and brighter stars—planets which do not revolve through their orbit thousands of times, but turn one face toward their mother sun at all times, and have on their surfaces an eternal summerland. Why should we live crowded on one sphere, a minor part of the family of a sun which is infinitesimal in comparison with the greater stars? Why should we die in feeble old age, when the whole universe is working for our good?

If our fate is written in the stars—if what the stars say, is really to be our final success or failure—then what is the use of ambition—work—sacrifice—love—friendship—the power to advance or digress? None. If the stars write our lives—what advantage is it to us to attempt to live them? None.

No! Science can never admit of the slightest iota of basic or surface truth in astrology—not as long as science teaches us that we really are the victims of the masters of our fates—that we can make ourselves—that in this sense and only in this sense are we above the animal—that we can make ourselves and those about us what we wish—to a limited extent. Astrology can never admit that, or it would break its own laws—and science can never admit of anything else. And which deals with *facts*—and which with *prophesies* and *coincidences*?

Let us see how many of Miss Bart's prophesies come true—if there is the least in astrology—*as must come true.* Will they? I, representing science, say no—astrology says yes. We will see which is right. Only science has the advantage. If one fails to come to pass, science is right. If all come to pass, astrology *may* be right.

EARLE B. BROWN,
Amesbury, Mass.

(Most astrologers do not say that the stars have infallible control over a person's destiny. They hedge in a most natural manner by saying, "The stars impel, but cannot compel." This then answers your question, "What advantages is it to us to attempt to live." We of course agree with your findings and a previous comment of ours on this same newspaper clipping appeared in this magazine.—EDITOR.)

$6,000.00

For Proofs of Astrology

SCIENCE AND INVENTION Magazine holds that there is nothing scientific in Astrology, that Astrology is not a science and that statements made by astrologers unless very general cannot be entertained seriously.

Accordingly, this publication has decided to award an Astrology Prize for $6,000 for the following:

$5,000 will be paid to the astrologer or forecaster who will foretell three major events of such a nature that he will have no control over the outcome of the same. He must describe in advance each event in detail, giving the location and result or the casualties if the event is an accident.

$1,000 will be paid to the astrologer or forecaster who will produce three accurate, detailed and perfect horoscopes, free of contradictions on the lives of three people whose initials will be given him when he requests the same and the birth dates and place of birth will also be supplied by this office.

This contest closes October 1st, 1927, and all entries must reach us by that time. In event of a tie, prizes of an identical nature will be given those so tying.

Address all entries to Editor, Astrology, care of SCIENCE AND INVENTION Magazine, 230 Fifth Avenue, New York, N. Y.

Tales From the Scientific Club

What the Typewriter Told

By RAY CUMMINGS

How a Mysterious Typewriter Was Used to Prove Premeditated Murder

"YOU say you know who the murderer is?" the Alienist asked.

"No," corrected the Doctor. "I said we know who committed the crime."

The Banker sat up abruptly with a gesture of impatience. "What's the difference? Why split hairs over technicalities? You said—"

"Wait George." The Doctor gazed around the private Club-room at the little group of members seated before him. "Gentlemen, this case is peculiar. We have proof of the criminal's identity. But the crime itself—the trouble is, we have no determination yet as to what crime was committed.'

"The man is dead," the Astronomer observed.

"Quite so. But manslaughter, murder, and most of all premeditated murder, are very different things."

"Very different," the Lawyer commented.

The Doctor added, "More than that, this crime on the surface appears to be only an attempt at blackmail."

"Why not outline the case for us?" the Banker demanded. "These hypothetical discussions——"

"I will," the Doctor agreed. A package lay before him on the table; he drew from it a litter of papers—anonymous typewritten letters, dirty and rumpled most of them; all of them on plain white paper of assorted sizes; and a variety of envelopes, all addressed in typewriting to "L. C. McIlray, 2860 Orange Ave., Maple Grove, New Jersey."

The Doctor spread them out. "The murder letters, gentlemen—I'll read some of them to you. First, the case briefly, is this: Leonard C. McIlray, up to the time of his death two weeks ago, was Advertising Manager of the Tonola Phonograph Company out in Maple Grove. A man of fifty-five, of exceedingly kindly, gentle nature, beloved by his employees. Nine years ago he was left a widower. He had fairly idolized his wife—yet in one short year he married his business secretary—a handsome dark-eyed girl then twenty-six or so. By his first wife he had one child, Alan, who now is twenty-eight. He was assistant to his father—he will now be advertising manager of the company. By this second wife there is one child—a little girl now five years old. Elsie—blue-eyed, golden haired. Her father worshipped her in inverse ratio to a seeming estrangement which of recent years was growing between himself and his young wife. And there was an estrangement—not outward, not admitted—between him and his son Alan, doubtless because the son did not approve of his father's second marriage."

"If this man got murdered," said the Banker, "I for one would like to hear how it happened."

"You shall, George, but those family details are necessary. McIlray died just after dinner at his home in Maple Grove. I must tell you one thing more. The man was in fair health, but for years his heart had been organically defective. With care—very moderate exercise—the avoidance of any severe digestive disturbance—and most of all the complete absence of excitement of any kind—he could have lived with that heart to his normal span. But gentlemen, understand me, he was in a chronic condition where any shock, any violence physical or mental, would have caused his instant death. And *this was known* freely to his family and his business associates.

"I come now to the murder—if murder it were. The family had just finished dinner. The front doorbell rang. The maid answered it; and it was the postman who handed her a letter for Mr. McIlray. This letter." The Doctor indicated one of the dirty typewritten envelopes before him. "McIlray recognized it doubtless. He did not open it, but suddenly excused himself, left the dining room with an agitation that was obvious. Later the maid said he had gone to his den—a small room on the lower floor off the hall. Alan went in there after him. He lay on the floor, dead, with a loaded revolver in his hand!"

"Suicide!" exclaimed the Banker.

"Don't be an ass, George. A shot would have been heard. The revolver had not been fired. There was not a mark on his body. He died of heart failure induced by sudden, violent mental shock."

"What about the letter he had just received?" the Chemist asked.

"It could not at first be found. When the physician came—Gentlemen, now we approach the pathetic aspect of this case. McIlray had been laboring for weeks under a terrible strain—a fear—and he had kept it to himself—had dared tell no one—except his little daughter Elsie. Only the child did he feel he could trust. When the physician arrived the little girl sidled up to him. 'My daddy said, if he got dead I must tell you to send for the police!' That was the message from the dead man she gave the family physician.

"Marberry here was called in. When he arrived, the child asked him naïvely if he were the police. And then she told him her daddy had said, 'Look in the organ.' An old-fashioned organ stood in a corner of the den. Anticipating a possible death, he had left his secret with the little girl, and faithfully—without knowing the meaning of it all—she had delivered his messages.

"They looked in the organ. Found all these letters, with the last one he had just received crammed in hastily after them. He

(*Continued on page* 356)

"These letters shocked Mr. McIlray and caused his death. As you know, the police suspected one of you five as the writer of them——" . . . "They suspected you," the Doctor reiterated. "They still do—but their grilling was unavailing, and they had no proof. We of the Scientific Club, however, now have proof! We know now which of you wrote those letters!"

MAGIC By "DUNNINGER"

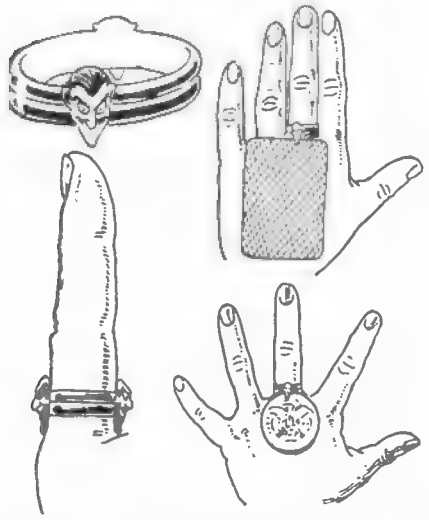
DUNNINGER
Joe Dunninger Tells How Prince Got Trick to Show Some Folks
DUNNINGER AMAZES TRIBUNE EMPLOYEES IN DEMONSTRATION
HYPNOTIST RULES SUBJECT BY RADIO
Reads Mayor's Inner Mind

THE MAN WHO MYSTIFIED Pres. Coolidge Prince of Wales, Ex-President Harding, Taft, Roosevelt, and other celebrities Writes Exclusively for SCIENCE AND INVENTION

Folks Are Mystified Yet Delighted by This Man!
Mind You! The Mind Reader Really Read the Mayor's Mind
DUNNINGER DRAWS HOME BIG CROWDS
Dunninger Will Attempt To Hypnotize Patient, 10 Miles Away, by Radio

NO. 53 OF A SERIES

DEVIL'S FINGER RING

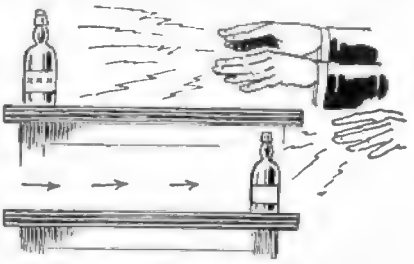


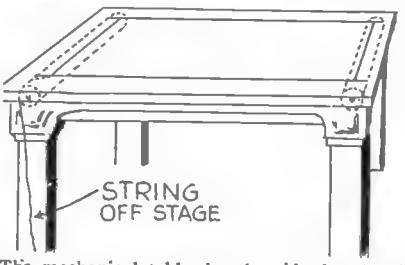
As is indicated in the illustration above, the magician provides the middle finger of his hand with a finger ring having two devil heads. These permit of palming cards or coins as shown.

Sleight of hand artists, only through many years of practice, are able to manipulate their fingers in such a manner as to conceal coins, playing cards, or other like small objects with any degree of perfection. This ring eliminates many years of practice and gives the amateur an opportunity of presenting seemingly impossible feats in sleight of hand which have heretofore been creditable to skilled professionals. A finger ring of the necessary design is illustrated. This can be made of any metal the performer chooses. The coins or cards are pushed under the projecting chin of the demon head where they hold the objects in tight contact with the skin. The two heads permit the coin or card to be held under cover of the palm or back of the hand.

HYPNOTIZED OBJECTS

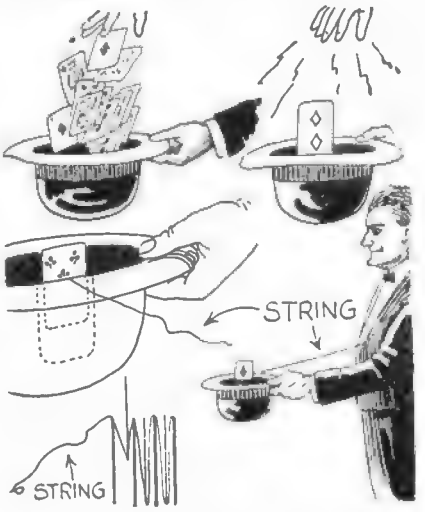
Now that spiritual effects and illusions bordering upon the psychic are in vogue, this illusion is bound to meet with the approval of the conjurer. A large table of simple design is standing upon the center of the stage and a box or bottle is placed upon the extreme edge of the table. Standing at a considerable distance from the table, the magician makes mysterious passes over the object and then drawing his hand away, the object will be seen to slowly and mysteriously travel toward the hand. The table itself is mechanical. Two rollers are concealed at the opposite ends of the table and over these a liberal length of black cloth is wound. This forms the table top proper. The rollers are worked by assistants beneath the stage, who, pulling upon a string, wind up either one roll or the other.





The mechanical table, by the aid of which it is possible to make objects move from one end to the opposite end. The stunt is seemingly mesmeric.

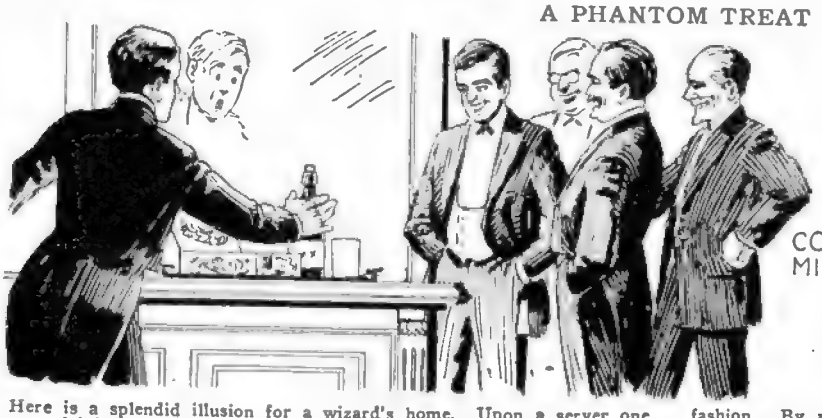
RISING CARDS FROM HAT



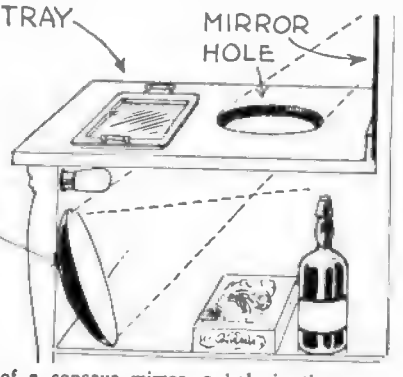
In this effect a deck of shuffled cards is dropped into a hat and any one of the cards or a whole series can be made to rise. An extra pocket and deck of cards are required.

Practically every magician understands the old rising card trick in which a houlette and string were employed. This effect is slightly different, but its presentation is far more spectacular and impressive. A deck of cards are shuffled and thrown into a hat, after a spectator had selected one and returned it to the deck. At the word of command, the chosen card is first made to rise and then immediately thereafter, cards in respective order come out of the deck. The selected card is forced. A duplicate deck, threaded as indicated, is then put in a concealed pocket attached to the side of the hat. The string tied to a shirt stud, serves to raise the cards up one at a time when it is stretched.

A PHANTOM TREAT



Here is a splendid illusion for a wizard's home. Upon a server one can plainly see a large box of cigars and a bottle of wine. The wizard invites his guests to help themselves, but much to the amazement of the onlookers, the articles prove to be but phantoms as the fingers of the disappointed guests pass through them in ghost-like fashion.



By arrangement of a concave mirror, a hole in the server and an ordinary mirror, this effect is produced. When standing directly in front of the server, the articles apparently rest on the tray. The objects themselves are located in the server and illuminated by electric lights.

Home Mechanics

How to Make a Self-Growing Plant Box

By W. M. BUTTERFIELD

THE self-growing, or self-irrigating, plant box is not a new invention, for it is the old Terrerium reconstructed to use, in a common practical manner, for raising house-plants. The selection of plants suitable for raising in a box of this kind is however limited to those that do not become too large or grow too rapidly, and to those with tough-leaves not prone to mildew, as is the case with the Geranium, which soon becomes affected with mold. The following kinds of plants have been recommended for culture in a plant box:

English ivy, Anthericum variegatum, Tradescantia spp., Cyperus alternifolius, Begonia Rex and its varieties, small ferns—pteris and polystichum—Selaginella spp. and Croton varieties.

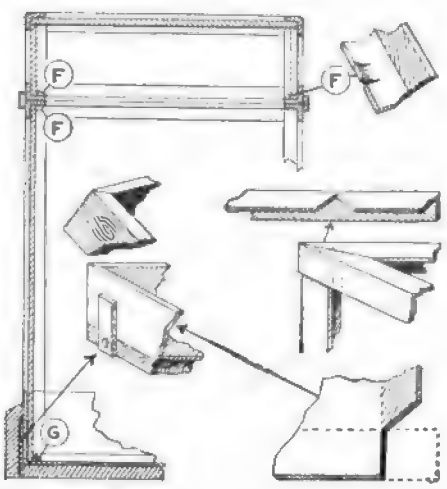
There is no magic in the way the plants thrive in this container, without watering and without care, for the explanation is simply that a case is provided so that the water vapor, which is a by-product of the green parts of the plant, does not find its way to the outer air, but collects by a natural condensing process on the inside surfaces of the glass, trickling downward to the soil, to wet it anew, thus providing water to be absorbed by the thirsty roots. The never-ending cycle goes on for months, the water diminishing gradually from the inevitable escape of some of it to the outer air.

The plants thrive best when the case is placed in a north window, or if put in a south window the case should be placed so that the plants do not have too much sunlight.

A number of boxes are tall and narrow; some are about square, others are quite small. A good average height will be 28"; the width, 18"; and the length, 29". Our design is for a box of these dimensions.

The materials for the box are as follows:

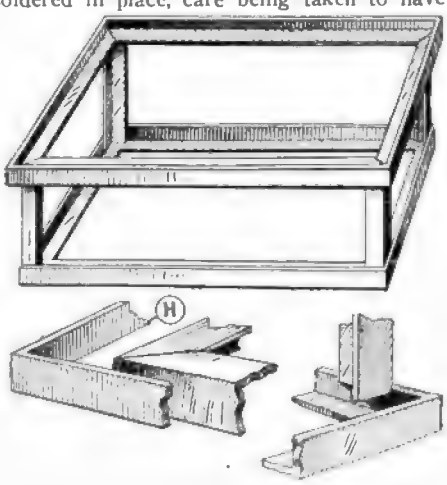
95" of ¾" lumber, 6" wide (for sides of base)
56" of ¾" lumber, 16½" wide (for bottom of base)
286" of No. 20 (1/16") Angle-monel ½" flange (for frame)
72" of No. 20 (1/16") Angle-monel ½" flange (for corners)
1 Piece No. 20 (1/16") 42" by 29½" monel (for bottom tank)
1 Piece Glass 17 1/8" by 27 1/8" (for top of cover)
2 Pieces Glass 5 1/8" by 27 1/8" (for long sides of cover)
2 Pieces Glass 5 1/8" by 17 1/8" (for short ends of cover)
95" of 3/32" flat monel ½" wide (for lip on top of box)



Further details of the construction of the box are shown in this illustration.

2 Pieces Glass 21⅛" by 17 1/8" (for lower ends)
2 Pieces Glass 21⅛" by 27 1/8" (for lower sides)
95" of 3/32" flat monel ½" wide (for flange in tank)

The monel tank, or earth holder, is first made from the large piece of metal. This is done by first cutting a square piece (5¾" square) from each corner; then turning up the four sides to form the tank; the corners are soldered when the tank has been completely shaped, squared and leveled. This job is a particular one, for the square, trim look of the box will depend on the way it is done. The wood bottom is next made to fit the under side of the tank, and secured to it, as illustrated, with ½" strips of monel—the strips are nailed to the wood and soldered to the tank. Next the sides are put on the base, first cutting out the wood to fit nicely over the monel strips; the ends of these pieces are mitered so as to make trim corners, and are secured with long thin finishing nails, the sides are also nailed to the wood bottom. Next the four ½" angle pieces, forming the corners for the lower part of the box, are soldered in place, care being taken to have

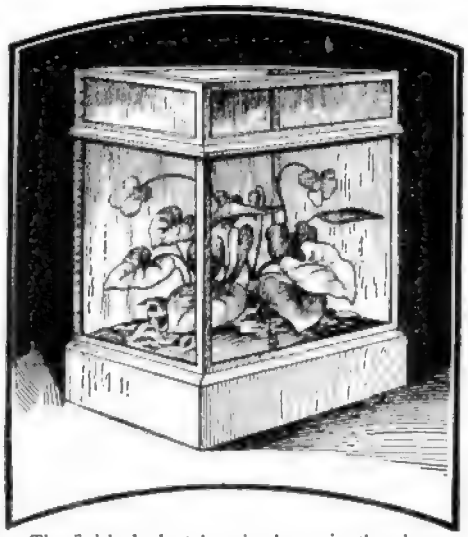


The construction details of the angles used in making the box are shown above. The metal is cut as shown and then soldered into place.

them of the same height at the top, square and perpendicular. The angle piece for the top of this frame is next cut so as to make a top 18" by 29" inside of the angle (flange) forming its sides. This top is soldered to the corner pieces, as shown. The top is bent and formed from one piece of angle monel, first cutting out square pieces at the proper places in the top angle and bending the corners so as to form miter-like joints. The ½" flange for holding the glass sides at the bottom within the tank is next soldered in place, leaving 1/16" more space than the thickness of the glass for cement. See Fig. G.

Both top and bottom angle pieces for the top of the box are made in exactly the same way as the top angle piece for the lower part of the box, and are the same in size. The corner angle pieces are then cut and soldered in the top and bottom, thus making the top frame. A flange, or lip, is made by bending the ½" flat 3/32" piece, as shown, then soldering it to the lower part of the frame so that it will lap ¼" on this frame and ¼" on the lower frame when the top and bottom frames are placed together. It is best to bevel the inside edges of the lip with a file, where it laps over the lower frame, before soldering it to the upper frame. See Fig. H.

Monel solders as readily as any of the



The finished plant box is shown in the above illustration. The silver color of the monel metal gives a good appearance to the box.

metals, but like other metals, the surfaces to be joined must be cleaned and all surface oxide, or tarnish, must be removed. This may be done by sandpapering then moistening with nitric or nitrous acid. The surfaces should then be tinned and carefully wiped, so as not to leave an excess of solder, unless this is done some difficulty may be met in flowing the solder into the joints. The ordinary "high or low" tin solder will answer for the work very well, and a good flux should be used at the time.

Glass for the box should be about 1/8" thick, of white, clear color and also transparent and free from bubbles or imperfections. Before having the pieces cut measure the inside of the frame, and thus check up on the figures given in the above text. If every thing is all right, have the glass cut square and exact to measurement. In the lower frame, as also in the upper frame, the sides are cut so as to go between the end pieces—thus holding them in place. The sides are held by the bottom flange G. and the clips F. Cement is also used both to make the box air-tight and to hold the glass firmly in the frame, as well as to cement the glass pieces together. A good cement for this purpose is the aquarium cement, on sale at most bird stores. In using the cement be sure that there is sufficient of it to fill all cracks or openings, so as to make everything tight—bottom, sides, top and everywhere. This applies to the openings between the glass and frame on the outside as well as on the inside.

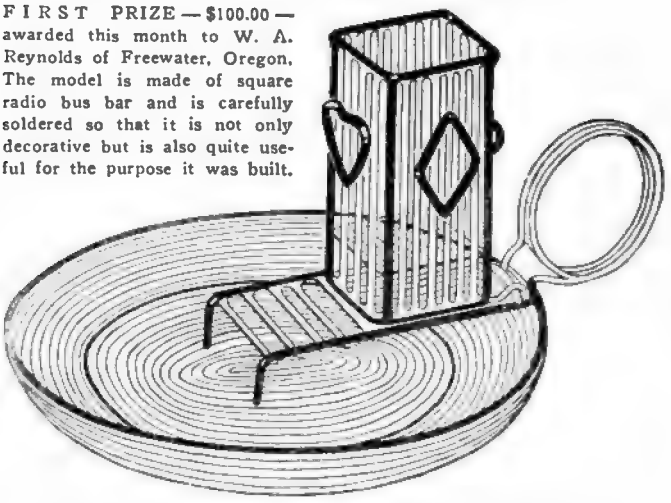
In putting the glass into the top frame turn the frame upside down, as shown in the illustration, and put in the top glass first with its cushion of cement, then put in the ends using the cement, and finally the sides also with their supply of cement. The sides and ends hold up the top glass, the sides hold the ends and the sides are held by the clips F, and the cement attaching them to the top glass. The outside of this frame is cemented as in the case of the lower frame. The cement should have two or three days to dry, when the top and lower parts are to be filled with water to see if each is water tight. If not, note where they leak, then empty and make tight with additions of cement when perfectly dry.

The metal parts can now be polished, the glass cleaned and the wood base enameled a velvet black. A rubber ring, such as is used on fruit-jars, is cemented to the flange form-

(*Continued on page* 363)

Wirekraft $3,000.00

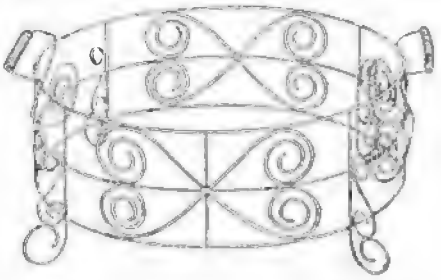
FIRST PRIZE — $100.00 — awarded this month to W. A. Reynolds of Freewater, Oregon. The model is made of square radio bus bar and is carefully soldered so that it is not only decorative but is also quite useful for the purpose it was built.



The ash tray shown above, which won first prize in this month's Wire Contest is entirely constructed of square bus bar which has been painted with aluminum paint to give it a good appearance. The oblong match box is hinged at the base, so that it can be used to clinch cigarettes and cigars. It is also decorated with the diamond, heart, club and spade, well known to those who play cards. These decorations are painted in red to give a finished appearance to the model. The bus bar wire is spiraled close and the spaces between are filled with solder, so that the cup will hold the discarded cigarettes and their ashes. The match box is arranged to hold the large type of strike anywhere safety matches.

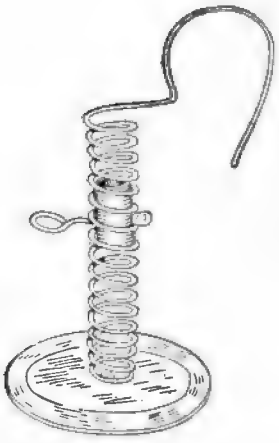
Second prize—$50.00. Awarded to Frank Brown, Brooklyn, New York, for his Wirekraft necklace. The design of the links is very ornamental and an ornament at the bottom is also constructed of the same wire.

Third prize—$25.00. It is a cap made of fine wire, to be placed on the top of the pipe to prevent the ashes and cinders from blowing out when motoring or in any strong breeze. It is constructed of fine brass and nickel wire giving it a neat appearance. The insert in the above illustration shows more clearly how the cap is constructed. The particular weave used gives a strong light article without preventing plenty of ventilation. This prize was awarded to Michael J. Thelen of Chicago, Illinois.



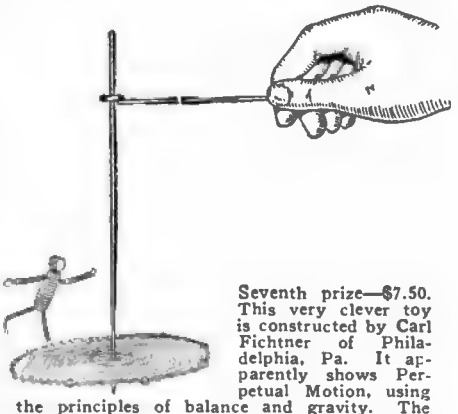
Sixth prize—$10.00 was won by Selmer Wick of Superior, Wisconsin, who constructed the casserole frame, shown above. The frame is made of copper wire bent into the design shown. This model being of actual size is a very useful one, the sides being quite ornamental. The handles are constructed of the same wire, wound close, so that a strong as well as neat handle is the result. The same design would also be adaptable for holding sugar bowls and other dishes. By using silver plated or nickel wire and silver solder, a very pretty holder would be the result.

Fourth prize—$20.00: Norbel C. Wood of Detroit, Mich., constructed the bottle washer shown above. It is equipped with a spiked chain on the end to facilitate the cleaning of bottles. The links of the chain and spikes are constructed of one piece, each link containing two spikes, one on each end. A long handle is used so that large bottles, as well as small ones may be cleaned with this apparatus.

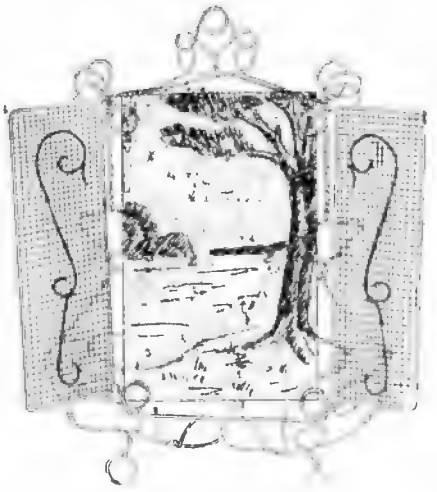


Fifth prize — $15. At the left we have an ingenious device, which can be used wherever a candle is needed. The holder is provided with an arrangement, so that the candle can be used right down to the bottom without lowering the height of the candlestick. As you may see, the candle is raised by turning the key around the spring holder.

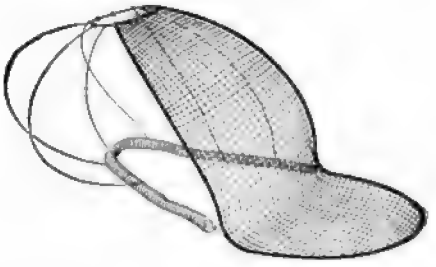
This prize was awarded to James Coll of North Bergen, N. J. It is constructed of heavy iron wire, painted to give a neat appearance. The handle is formed by bending the top of the spring into a larger spiral.



Seventh prize—$7.50. This very clever toy is constructed by Carl Fichtner of Philadelphia, Pa. It apparently shows Perpetual Motion, using the principles of balance and gravity. The figure shown on the rim of the wheel is quite heavy and is arranged so that it is slightly off balance. In this way, the figure apparently starts to move as soon as the rod is exactly vertical. In reality, however, it will stop moving after a short time if the vertical rod is held still. The model is constructed of copper wire and brass rods. The wire is soldered into place, at the point where the wheel and the vertical rod are joined. The doll is weighted with lead, so that it will be heavy enough to keep the wheel in motion for a long time.



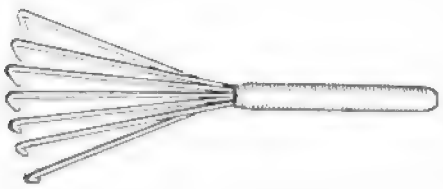
Eighth prize—$5.00 was awarded to John G. Dengler for his Wirekraft photograph frame. The model was constructed of copper wire, bent into the form shown above. The screen-like sides are hinged, so that they may be folded back to protect the picture when it is not being displayed. This is a very useful article and may be duplicated very easily by other Wirekrafters. It may be made in any size to hold either small snapshots or large portraits, and the protecting screens may be covered with cloth to better protect the picture. A frame is hinged to the back, so that the frame may be stood up on a bureau or other point of vantage.



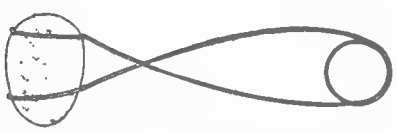
Ninth prize—$3.50. The cap shown above was constructed by Norvell C. Wood, of Detroit, Mich. It is made of copper wire and screening. The base is equipped with a spring so that the cap will fit anyone. The screening on the front can be covered with silk to shade off the sun and thus make a useful article. This cap reminds one of the phantom caps with celluloid visors, so extensively used two or three years ago.

Tenth prize—$2.00 was won by John Zeleznik of Bridgeport, Ohio. It is a bouquet holder, constructed entirely of wire. A number of stiff copper wires were bunched together at the bottom and a ring was bent at the top of each wire. The stems of the flowers are pushed through the loops and thus a rigid bouquet holder is formed. By grouping any number of wires in this way, a large or small bouquet may be formed. The wires were painted green, so that they would not show very clearly in the bouquet.

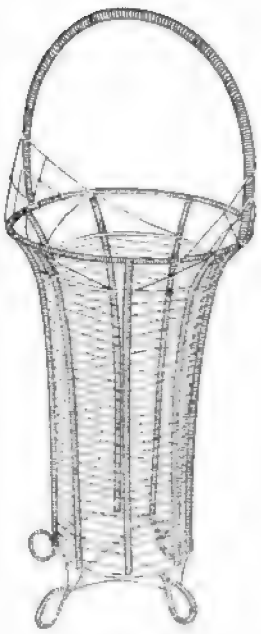
Contest in Prizes



Eleventh prize—$2.00. This garden rake constructed by Francis J. Lorenz of Newark Valley, New York, won the eleventh prize in this month's Wire Contest. It is constructed of heavy iron wire and the handle is formed by welding iron to the end and grinding it down smooth. This article is very well constructed and is very useful to the gardener in weeding his yard. The ends of the wires are filed sharp to facilitate the removing of weeds. This article could have been more easily constructed by winding the handle from wire, instead of welding it on.

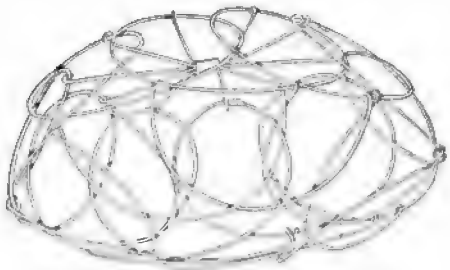


Twelfth prize—$2.00—was awarded to J. T. Patterson, Jr., of Montgomery, Alabama. It is constructed of copper wire bent in the form shown above. This article is very useful for lifting eggs from boiling water, without cracking them or burning oneself in doing so.

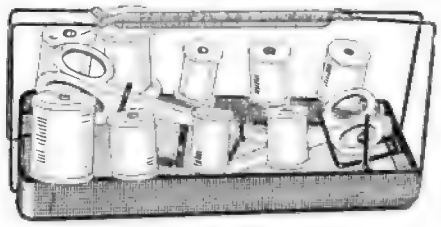


Fifteenth prize—$2.00. This basket won the fifteenth prize in this month's Wirekraft Contest. It was constructed by Peter J. Nicholas of Foxcroft, Maine. The main supports are constructed of heavy iron wire wound with fine copper wire. This basket would be useful for holding flowers, if a glass were placed inside.

Did You Note that the Matchcraft Contest is to be discontinued?



Thirteenth prize—$2.00—was awarded to M. H. Eida of Alameda County, Calif., for his model of a soap dish. The weave of this basket is so arranged that the top may be raised and lowered. It is constructed of heavy copper wire, each loop being joined separately to the basket. This design could be used for many forms of wire basket work and has the advantage of being easily constructed.



Fourteenth prize—$2.00. This Wirekraft sewing basket was constructed by Linwood F. Mantler of Baltimore, Md. It is provided with supports for ten spools of thread, a thimble, packages of needles, and two pairs of scissors. The handle and supports are constructed of heavy wire, painted to give a neat appearance.

Sixteenth prize—$2.00—was won by Eugene Jefferies of Anacortes, Wash., for his Wirekraft cuff button set. The cuff buttons are arranged so that they may be separated. The collar buttons are made of one piece.

RULES OF WIREKRAFT CONTEST

THIS is a wirekraft contest. Hence wire is to be used in the construction of all of the models entered in this contest.

The size of the wire to be employed is limited. The heaviest wire must not be larger than No. 8 American or B and S gauge, and the smallest no smaller than No. 30 B and S gauge—or (for foreign countries not having these exact sizes), the nearest available equivalent.

No. 8 B and S gauge is .12849 inches in diameter or 3.264 millimeters. Its nearest equivalent in the Birmingham or Stubs iron wire gauge is No. 18. In the Stubs steel wire gauge it is No. 30; in the British Imperial Standard it is No. 10. The nearest wire to No. 30 B and S gauge which is .01002 inches or .2546 millimeters in diameter is No. 31 in the Birmingham or Stubs iron wire gauge. In the Stubs steel wire gauge it is No. 80; in the British Standard it is No. 33.

The builder may avail himself of the opportunity of using any intermediate sizes of wires between No. 8 and No. 30, B and S gauge.

The wire may be copper, brass, iron, steel, or these materials coppered, tinned, nickel-plated, or galvanized, or the wire may consist of an alloy. Any kind of wire available on the market may be employed.

It is preferable to use non-rusting wires. The publishers will not be responsible for the rusting of any model. To protect wire which rusts easily or for color effects, the models may be painted, lacquered, varnished or otherwise covered.

Any additional decorations or accessories may be employed to enhance the effect. (Example: Silk on a lamp shade; glass in decorative fixtures; electric motors for operating mechanisms, etc.)

Only those portions actually constructed of wire will be judged.

(Example: A reed basket is suspended from a wire chain. The basket not being made of wire is NOT considered. On the merits of the chain only will the prize be awarded.)

Wires may be twisted, spliced, soldered, welded or bound together. Wire may be used to bind other wires together. If soldered a non-corrosive soldering flux should be employed.

There is no limit to the size of the models which may be entered nor to the number of entries which any maker may submit during any calendar month.

In every case the model must be forwarded express prepaid to SCIENCE AND INVENTION Magazine. It should be tagged with name and address of the maker, who will prepay charges if model is to be returned.

The first prize will always be awarded to a model possessing the greatest utilitarian merits. This must be an object NOT found on the market today.

The second prize will always be awarded to an object possessing the best decorative, artistic or constructive effect. It may be a replica of an existing object or a model of an imaginative object or effect.

The remaining prizes will be judged from either one or the other viewpoints at the discretion of the judges.

All models may remain at the office of this publication until the close of the contest at the discretion of the editors.

This contest starts January 7st, 1927, and will terminate January 1st, 1928.

This is a monthly contest lasting for twelve months, each monthly contest closing on the first of the month following dates of issue. Thus the contest for the month of August, 1927, will close September 1st, 1927. Winners for August will be announced in the November issue.

$3,000.00 In Prizes

Arranged in Monthly Awards

First Prize	$100.00
For Utility Only	
Second Prize	50.00
For Artistic, Decorative or Constructive Effect—may be a replica or model of some imaginative or existing object.	
Third Prize	25.00
Fourth Prize	20.00
Fifth Prize	15.00
Sixth Prize	10.00
Seventh Prize	7.50
Eighth Prize	5.00
Ninth Prize	3.50
10th to 16th Prizes of $2.00 each	14.00
Total	$250.00

Tools Required

THE tools required for the construction of Wirekraft articles may be found in the Dec. issue of this publication, a reprint of which will be sent free upon request. The following tools may be used advantageously:

1 pair flat-nosed pliers, 1 pair round-nosed pliers, 1 wire cutter, 1 hacksaw, 1 small vise, 1 soldering iron.

The materials which are necessary are:

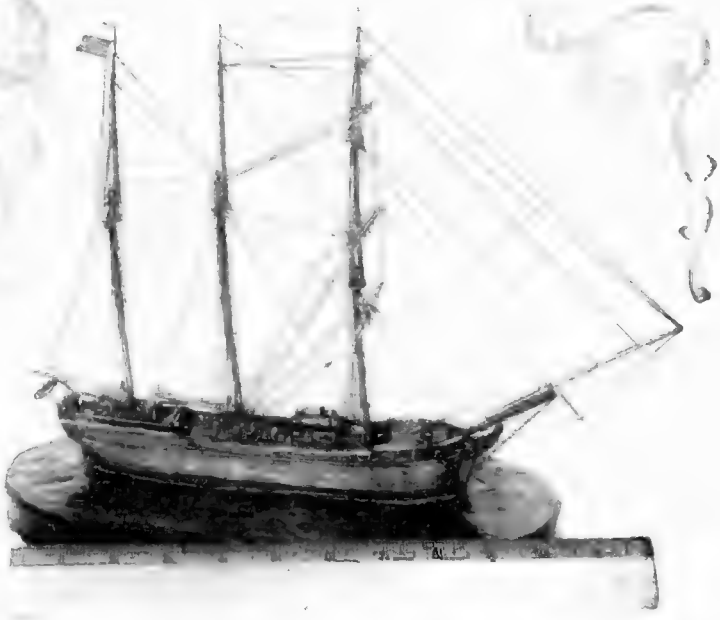
Solder, soldering paste or flux, nails, one piece of wood, and most important of all, wire of the sizes specified in the contest rules and regulations.

If the builder decides to weld his wires together, a small welding transformer or a storage battery may be used for this purpose. For the formation of long cylinders, a coil winding machine or a lathe may be advantageously employed. Toy motors for the operation of any devices constructed of wire could of course be procured and added to the model and the addition of miniature sockets and bulbs to illuminate the interior of any buildings constructed of wire might also find a place in some of the constructions.

Address all entries to Editor Wirekraft

SCIENCE & INVENTION MAGAZINE
230 Fifth Avenue, New York City

Matchcraft $100.00 Awarded Monthly



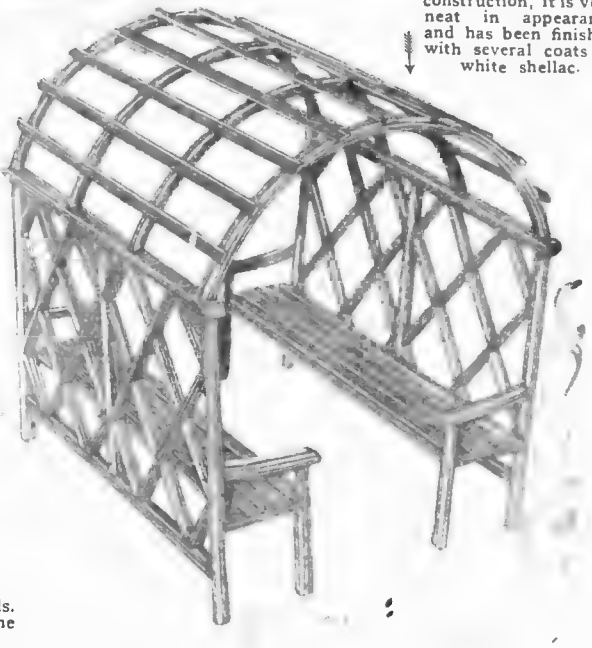
First prize—$50.00 was won by Raphael Gueril of Brooklyn, N. Y., for the Barkentine shown in the two views above. The total length of the model is approximately 13½" as may be seen from the ruler resting against its base. This delicate model floats in an artificial sea, is correct in every detail and is finished in colors. The boat is square rigged on the foremast and fore and aft rigged on the other two masts. The supporting base of the model is also made of matches.

Second prize—$20.00 was awarded to E. J. Raible, of Louisville, Ky., for his matchcraft model of a lawn mower shown at the right. The blades are geared to one of the wheels and actually revolve when the mower is pushed. The model is entirely constructed from matches and can be taken apart with ease.

Third prize—$15.00 was won by Irving Klein of Brooklyn, N. Y., for the construction of the slipper appearing at the right. The buckle is beaded in a pleasing design. The slipper is made to exactly conform with modern styles and has a 2¼" heel. The model was polished to a smooth mirror-like finish.

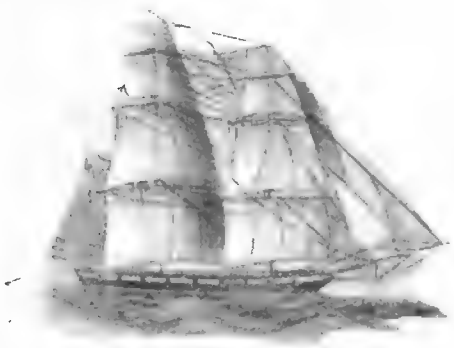
Fourth prize—$10.00 was given to Fred Spinden of Abingdon, Illinois, for the garden seat shown in the photograph below. The seat is of artistic construction and the matches were steamed so that they could be bent to make the curved part of the model. The lattice work on the sides is of novel construction. Although the model is of relatively simple construction, it is very neat in appearance and has been finished with several coats of white shellac.

Fifth prize—$5.00 was given to the garden fence shown below, which was constructed by Frank De Guerre of "Rocky Point," Ville Grande, Colorado. The lattice work has been constructed from long strips of matches which were arranged in a criss-cross fashion. The model was finished in red and white.



IMPORTANT NOTE! With this issue the $100.00 monthly Matchcraft Contest is discontinued. This contest, originally a $5,000.00 contest, was changed to a $100.00 monthly contest to permit those already engaged in Matchcraft work to enter their models. All models arriving on or before the first of August will be entered in the final month's contest. Refer to the previous issue for the rules.

MODEL DEPARTMENT



A line drawing of a brig-of-war under full sail taken from the "Kedge Anchor."

Building a Model *of the* U. S. Brig of War "Truxton"

By WILLIAM A. CROSBY

INTRODUCTION

DURING the last few years the nearly lost art of ship model building has been resurrected and although predictions have been made that it is only a passing fancy, a whim of the public, it would seem that there is practically no basis for such a statement. Apparently ship models and their making have taken the public fancy with the result that the craze, if we may call it that, instead of passing on, is rapidly gaining converts and thousands of model ship yards are hard at work turning out miniature ships of every conceivable nature .

It is with a feeling of some trepidation that this article has been prepared, for there will be the experts to appease, that little class of seafaring men who delight to pick apart the work of others in their line of endeavor. The story may not be perfect, we admit that from the start, but it is not supposed to be a complete course in naval architecture and seamanship, but is rather intended as a work of authentic information for the great middle class of model builders, those who want to do the thing right, but who become lost in the maze of technical terms with which our salty friends love to steep their minds and the minds of any unfortunates who happen to fall under their spells.

We do not set ourselves up as an old sailor or an old salt, as you will. We have never rounded the Horn in a howling gale nor have we ever been farther to sea than a few miles, just enough to lose sight of land and our sole experience with "wind jammers" has been confined to sailing yachts and canoes of various and sundry kinds.

Brought up under the eagle like gaze of a father who knew the sea in all its moods and who knew sailing craft as he knew his own home, it is but natural that the sea and things pertaining to it, should attract us from the first. The result was some twelve or fourteen years spent over the drafting boards of a naval architect, the building of various craft of different kinds and now a deep respect for things nautical and a room full of models of every sort and description.

We have secured and studied seriously the old books on seamanship; Brady's Kedge Anchor or Young Sailor's Assistant, Luce's Seamanship, and any number of more obscure works on the subject. A sailor aboard ship may not know the entire technique of his craft, just as the auto driver seldom knows what goes on under the hood of his car and so with a background of facts gained through careful study, it would appear that what follows on these pages may contain information in a non-technical way which will prove of interest to those of you who are fond of doing things with your hands, yet who do not like to be worried with long names which, after all, mean nothing in this day of steam ships and other mechanical means of transportation.

What follows is prepared with only one end in view; the building of a single ship of a type which has long since become extinct. The story is told in the simplest language and yet with enough technicality to add a spice of saltiness to the tale. The model is not of the usual variety and is therefore to be classed as "rare" in this era of clipper ships and near galleons. It is a real ship, made from authentic data, and before setting sail we want to take the opportunity to express our thanks to the editor of "Motor Boat," Charles Hall, who has lent his hearty cooperation on the knottiest problems and who has always stood by, ready with a life line, when the model of the "Truxton" was in danger of becoming a wreck.

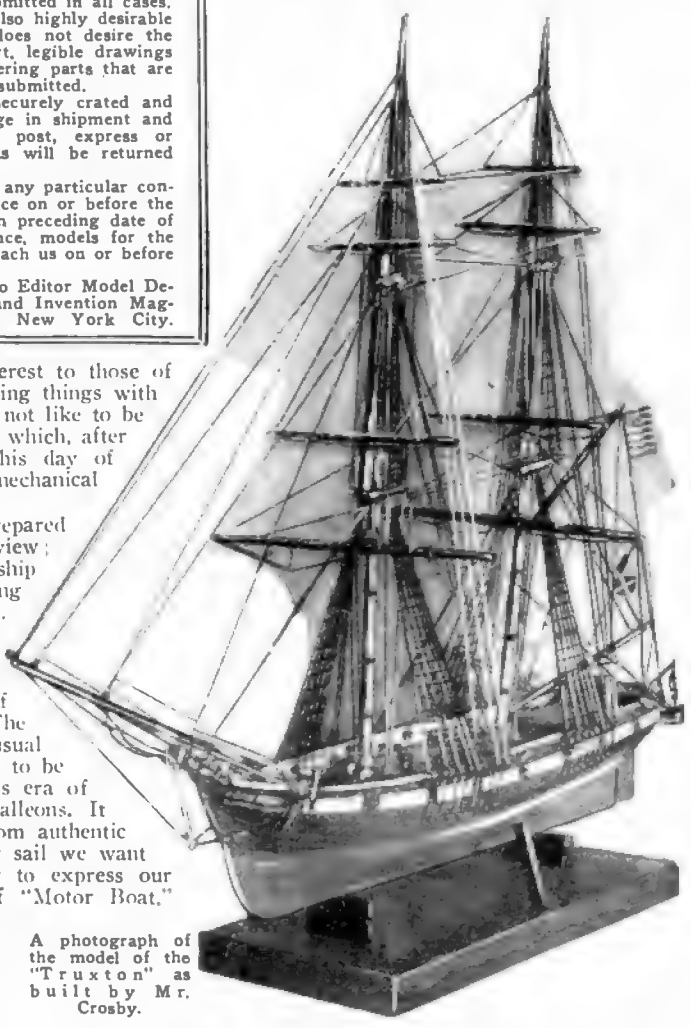
"Shove off!"

Rules for Model Contest

1. A handsome trophy cup engraved with your name, will be awarded as the prize for the best model submitted during the month. The decision of the judges will be final and will be based upon, A—novelty of construction; B—workmanship; C—operating efficiency of the model as related to the efficiency of the device which the model simulates, and D—the care exercised in design and in submitting to us sketches and other details covering the model. See page 236.
2. Models of all kinds may be entered. They may be working models or not, according to the subject that is being handled.
3. Models may be made of any available material, preferably something that is cheap and easily obtainable. Models made of matches should not be submitted to this department but should go to our Matchcraft Contest Editor.
4. Models must be submitted in all cases. Good photographs are also highly desirable and where the maker does not desire the model to be taken apart, legible drawings with all dimensions covering parts that are not accessible must be submitted.
5. Models should be securely crated and protected against damage in shipment and sent to us by parcel post, express or freight prepaid. Models will be returned when requested.
6. Models for entry in any particular contest must reach this office on or before the 25th of the third month preceding date of publication. For instance, models for the October contest must reach us on or before the 25th of July.
7. Address all entries to Editor Model Department, c/o Science and Invention Magazine, 230 Fifth Ave., New York City.

THE MODEL

Undoubtedly you have seen, in department or furniture store windows, devices which are supposed to look like miniature ships. Usually, if you have paused long enough to take a second look at these abortions, you have promptly made up your mind that the ships of years gone by must indeed have been clumsy and ugly. Most of these so-called ship models display the crudest kind of workmanship and are daubed up with great gobs of paint in apparent defiance to all the laws of man and nature. These models have done just one good thing; they have awakened hundreds of people to the real beauty of an authentic model and the painstaking care necessary to turn out such a work of art. A real model cannot be made on a production basis.



A photograph of the model of the "Truxton" as built by Mr. Crosby.

The "Truxton"

The only kind of a ship model worth having is a real one of a real ship—a ship with a history and one which shows character in every line. One of these reposing on your mantel or desk will cast a spell over you. You will be able to study it for hours, permitting your imagination to run riot and the more you do this, the more firmly you will become attached to your "ship."

If you have priced real models, though, you will probably make up your mind that you would rather buy a medium priced car with the same money—for real models are tremendously expensive, but is it any wonder?

However, real ship models may be made by almost anyone, provided they are blessed with a reasonable amount of patience and the necessary data for accurate work is at hand. A full rigged ship model cannot be built in an evening or a month. Such a ship must be worked on when the spirit moves and the time of completion must not be considered until it suddenly breaks upon the builder that his work is finished. The work cannot be hurried and a builder must be prepared to even undo several weeks' work in order to place in some fitting or line which was left out at the time of construction. Such a model as we are about to describe *may* be made in three months if it is worked on religiously in spare time. It is more apt to take six months or longer in construction.

The writer has made possibly a dozen or fifteen models, everything from the old Santa Maria of Columbus to a modern motor cruiser and each on a diminutive scale. If you wish, you may buy fittings and parts, rigging cord, blocks and hundreds of other small parts, but half the fun of this work is to do the entire job yourself.

Most of the difficulty lies in securing accurate data from which to work. Plans may be bought here and there but they are mostly of ships which have become common as ship models. There must be fifty thousand "Flying Clouds" in the country and I doubt if anyone could ever guess the number of "Santa Marias" or "Mayflowers" and this despite the fact that no authentic data can be secured on the latter ship.

There are several books on the subject of model building, but it is unfortunate that out of the lot, there are only a few which are really worthy of the name. Much misinformation has been printed on the subject and the department store models have come in for their full share of publicity. However, these things are bound to happen where misinformation is the rule rather than the exception. Let's get on.

Probably one of the most interesting periods of the United States Naval and maritime history comes in the early part of the nineteenth century. It was then that our merchant marine was the greatest in the world and there were thousands of ships which went through the wildest and most interesting experiences. It was the period of fast clipper ships, pirates and real heroics in the Navy. American ships were the fastest and "tallest rigged" vessels on the seven seas and in fact this was carried so far that at one time several of the Naval vessels went to sea and were never heard from again. The American flag was to be seen on every sea and ocean and although the Navy was of rather small proportions and the steam vessels were considered by many to be absolute failures, these ships were able to handle themselves in the most approved manner of the day. This was apparent during the war of 1812 when hundreds of fleet ships were turned into privateers and the United States was admittedly the strongest sea power of the time.

The writer happened to be fortunate in securing several old books on seamanship, rigging and handling ships of the time and also, in the "United States Nautical Magazine and Naval Journal" to find some extremely interesting drawings on ships, some of which are famous to this day. This particular volume represents six months' editions of this magazine published in the year 1856 and in it the lines and sail plan of the U. S. Brig-of-War "Truxton" were found. This little ship, only one hundred feet between perpendiculars, was considered one of the fastest sailers of that day, which fact is quite apparent when one studies the tremendously lofty rig that she carried. We have a letter from one of her officers which says that on her station, in the West Indies, she has repeatedly beaten every ship there, including the famous "Saratoga."

The lines of this ship were found to be drawn on a scale of one-eighth of an inch to the foot and it was at once apparent that this would make an excellent subject for a model.

At the time when this ship was built it was customary for a ship builder to work directly from a model. All dimensions were measured from this, but in the science of modern naval architecture the drawing is made first and the builder works from this. The original drawings of the "Truxton's" hull were made from a model of the ship and were published at that time.

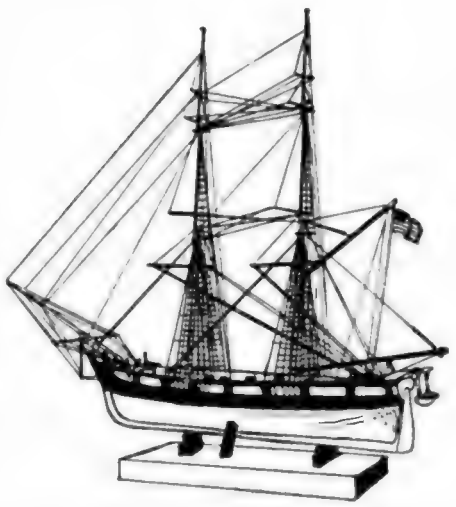
Like all mechanical drawings, the lines of a ship must be given in three planes; the plan, elevation and the sections. Each must conform to the measurements of the others before the drawing can be considered perfect and the work is made doubly difficult because the entire surface is made up of curves. At the present time, these drawings must be made extremely accurate for the actual ship if measured and the dimensions laid down in the "Table of Offsets" by the draftsman. The slightest error in one part of the drawing may easily throw out an entire section somewhere else and the line drawing is usually given to the most experienced and careful draftsman. The curves must hold a fair shape throughout the hull and an experienced eye will pick out the flaws almost instantly.

At the time of the "Truxton" the entire plan was worked out around what were called water lines. These lines, usually entirely unrelated to the actual line of flotation, were the means of taking measurements from the elevation to the sections and from the sections to the plan. (See page 333.)

Now let us regard the elevation of the ship. The highest line, the one with a slight curve in it, represents the line of the rail or the highest point of the hull structure. Below this comes another curved line which is known as the sheer. It has slightly more drop to it than the rail and is usually located on the side of the ship at a point the thickness of the decking below the level of the main deck.

The next one below this is known as the rabbet line and, as you can see, it follows up at the curve of the stem or bow and also at the stern. This represents the line which the ship's planking will follow when it joins the keel, stem and stern post. Below this, of course, comes the line of the keel which rounds up at the bow and is squared off at the stern. The rabbet line, on a real ship, is really cut into the keel, stem and stern post so that the planks lay flush with the surface of these members, but this is not strictly necessary where we use cardboard which may be sandpapered down smooth.

Extreme accuracy is necessary to have all of these dimensions laid off accurately in order that the ship may look right when completed. The plan shows the exact contours of the stem and also dimensions for the rest of the keel and rabbet and if you wish you may make a paper template of the whole thing, working with a ruler to take the measurements and then, when the spots are marked in, joining them all up with a curved or straight line according to the nature of the work. This paper template may be laid on the wood from which these members are to be made and with a piece of carbon paper between, it is an easy matter to mark off the outline. Once this is done a sharp razor blade may be used to cut away the excess material, for the keel is only an eighth of an inch thick and will cut easily. The edge may then be sandpapered to make it smooth and fair.



Another illustration of the Truxton. The building of this model will be completely described in this journal. Each and every step will be made clear enough for the layman to follow.

Now look at the plan view. One curved line, is marked "Rail Line" and it represents the line which would appear if we were looking directly down on the model. This is, of course, the highest line of the hull itself. The other line is the water line and it will give an idea of how the ship is shaped, for it is considerably wider amidships than the line of the rail. This bump on the side of the ship is known as "tumble home" and is put there for several good reasons. This waterline, by the way, would be a section of the model if it were cut off horizontally on the dotted line shown in the sheer plan. The sheer plan is the naval architect's term for the elevation.

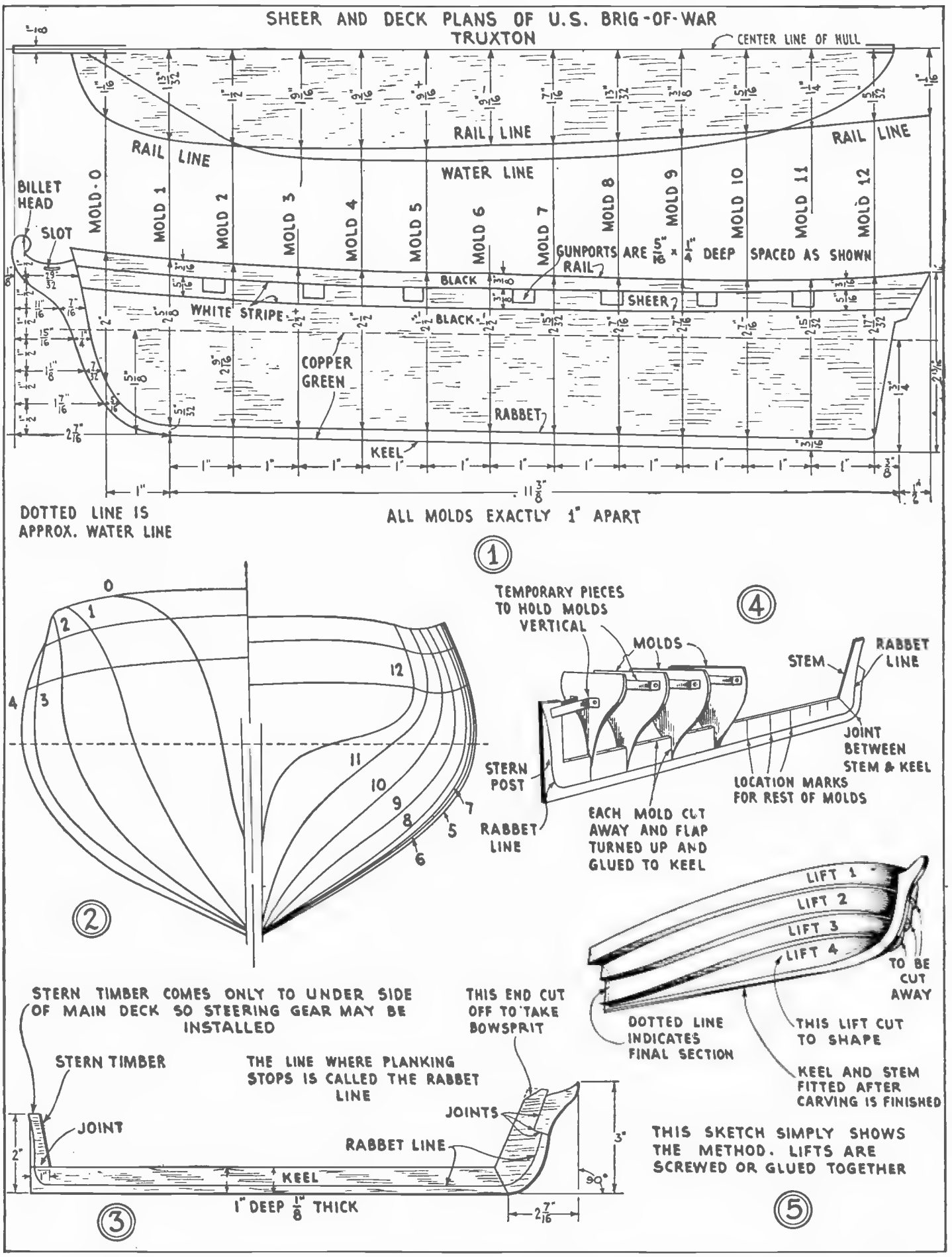
You will note that in the sheer plan, at intervals of one inch come vertical lines shown as molds. These are also shown in the deck plan above the sheer plan and each of these lines represents a section of the model if it were sliced off straight across at that point. If, therefore, we make the keel according to the dimensions given and then erect these sections on the keel at their proper spacing, it is quite apparent that we have a good representation of the shape of the hull.

The body plan shows these sections and by studying the plan you will see that each section is numbered to correspond in both body plan and also in the sheer and deck plans, 2. In this body plan or sectional drawing the bow sections of the model will be seen on the left hand side while the stern sections are on the other. This drawing is the exact full size of the model and from it you will make the molds.

If you use the sharp pointed instrument to make holes in the plan, be sure to make a sufficient number of holes to make it easy to follow the curve correctly. Since the drawing only shows one-half of each mold it will be necessary to make one side and then turn the drawing over in order to mark off the other. If you do this, be sure to get the center lines directly over each other and also make sure that the heights are the same. If this is not done the model will be higher on one side than on the other.

(To be continued in the September issue)

U. S. Brig of War "Truxton"



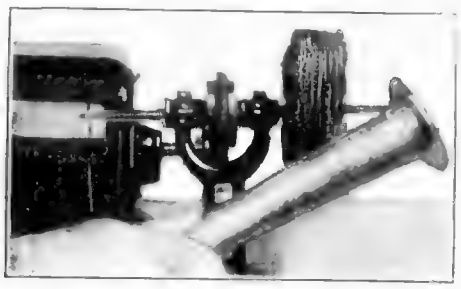
1 indicates section lines of the body. Each vertical line is a cross-section. 2 is the body plan showing the boat as if it were cut in sections. The bow section is at the left hand side and the stern section on the right. This is full size. 3 gives the dimensions for keel, stem and stern. 4 shows how the molds are erected on the keel and 5 shows how the wood is laid in layers on the molds.

Electroplating Made Simple

PART TWO

By RAYMOND B. WAILES

AFTER electroplating the work must be polished by some suitable means. Undoubtedly the best method is the use of the buffing wheel, but unfortunately this requires the use of a high-speed motor. Successful polishing or shining up



Polishing an electroplated article with an electric motor and a rag wheel.

the plated articles can be done with the many silver polishing pastes and creams upon the market.

A fairly good polishing cloth can be made by soaking pieces of outing flannel in a mixture of two quarts of gasoline, one-quarter ounce of oleic acid and a pound of whiting. The cloths are soaked in this solution, then stirred about, removed and dried. This evaporates the gasoline and leaves the whit-

Polishing by a hand-cloth

ing adhering to the cloth by means of the wax-like oleic acid. The cloths are used after drying, without the aid of water. They should not be washed out.

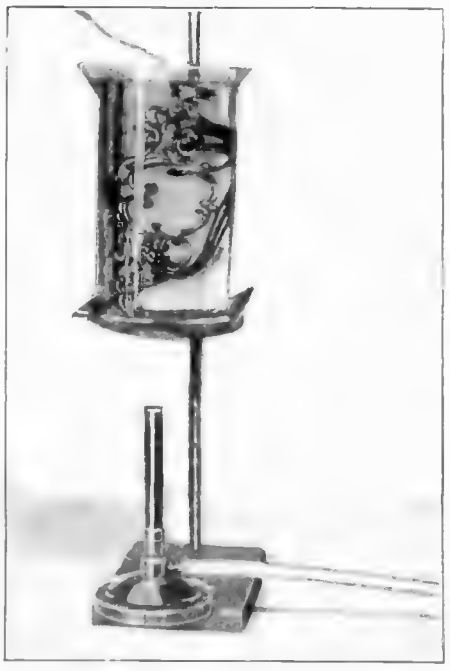
Another polishing compound is made by mixing equal parts by weight of powdered

Making up a polishing-cloth mixture with different agents.

rouge (a very finely divided form of iron oxide), chalk, and magnesium carbonate. A moistened cloth is dipped into the powder and rubbed on the article to be polished.

Silver articles which have become tarnished by the action of sulphur compounds can be cleaned by boiling them in an aluminum pan containing a solution of baking soda in water.

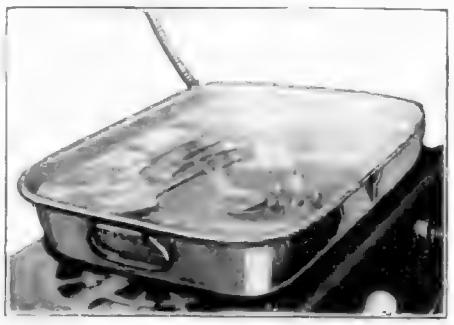
The plating of metals can also be accom-



Electro-plating without a separate battery.

plished without the aid of a battery. One such method is by immersion; another, by contact. A piece of iron immersed in copper sulphate solution will become plated with copper. If an object to be plated with nickel is connected directly to a strip of aluminum by twisting the aluminum about some sharp part of the object and immersing the combination in a solution containing 30 grams of nickel sulphate and 25 grams of ammonium chloride dissolved in 1000 grams, or cc, of water and heated to about 85 degrees Cent., (185° F.) the object will take on a coating of nickel. Five minutes' immersion is sufficient to coat it slightly.

Nickel plating can also be done by moistening a cloth and with it rubbing some of

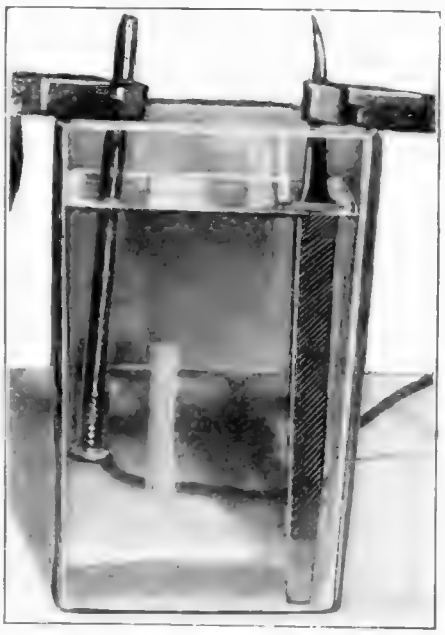


Cleaning silver by electric action, with baking soda and aluminum.

the following mixture upon the metallic article to be plated. The powder is composed of:

Nickel ammonium sulphate...	60 parts
Magnesium powder	3 parts
Powdered chalk	30 parts
Talc powder	7 parts

The nickel coating which is secured by this method is not very thick and is derived from the nickel ammonium sulphate. The magnesium powder acts as an electrode, which causes a current to be produced when



Sharpening files with the battery.

the wet cloth is used. The talc and chall act as polishers.

As a side line to electroplating, the coloring of metals by chemical means can be performed. For instance, to make brass articles

(*Continued on page 379*)

The Transformation of Cellulose

By DR. ERNEST BADE

ALL kinds of plants provide us with cellulose, but its purest form may be directly obtained from cotton. Worked up with chemicals of various sorts, it produces compounds that not only provide us with luxuries, but also with some real necessities of life, among which are paper, artificial silks, celluloid products and explosives. In lumber it furnishes us building material and in the distillation products of wood we obtain many solvents and other chemicals.

Cellulose is never pure in the form of lumber, but is always accompanied by a substance called liber, which is formed every year at the period of growth. This

Two cubic centimeters of concentrated nitric acid are mixed with four cubic centimeters of concentrated sulphuric acid. Add absorbent cotton, let stand for a minute.

is gradually transformed into wood by various bodies known as encrusting substances which are imbedded in the cellulose mass. It is this mass which must be destroyed by various chemicals which do not affect the cellulose itself.

Fairly pure cellulose can be prepared by first drying sawdust in a hot air bath heated to 110 degrees C. (230° F.). The hot air bath may be prepared from two tin cans, one within the other, the saw dust being held in a small evaporating dish over which

At the end of the minute add water to break the reaction and then thoroughly wash the nitrated cotton and dry in cool air.

a thermometer is suspended. The dry sawdust is then placed in a flask and a mixture of alcohol and benzol are added. After attaching a reflux condenser, the mass is extracted for a few hours and the resinous matter will go into solution. The liquid

Mix equal parts of nitric and sulphuric acids, heat the mixture to 50° C (122° F) and add cotton. In ten minutes add water and wash.

is then poured off, the sawdust washed with alcohol, and then again extracted with ammonia for a few minutes. The ammonia solution is renewed twice during this short process of extraction. The mass is then washed with water and bromine water is added; the flask is not to be heated during this process. As soon as the bromine water loses its brown color, pour off the water and add fresh bromine water. Repeat the operation until the weak bromine water does not decolorize after standing 24 hours.

Make collodion by dissolving the lower nitrates in a mixture of alcohol and ether.

This oxidizes the vasculose and converts it into soluble acids. Remove the solution and wash the mass remaining with water. Then heat the sawdust almost to the boiling point with water containing 2 cc of concentrated ammonia water for each 250 cc of water. Repeat the heating with fresh solutions until the mass no longer increases its brown color. Then repeat the operation with the bromine water solution, again wash the mass thoroughly with water and boil with alcohol. The mass remaining behind is pure cellulose.

When cellulose, either purified sawdust or cotton, is treated with nitric and sulphuric acid, cellulose hexanitrate is formed. This is an explosive and is generally known as gun cotton or pyroxyline. Mix 2 cc of concentrated nitric acid with 4 cc of concentrated sulphuric acid and cool the mixture. When cold, add the cotton (cellulose) and immerse it with a glass rod so that all of it is moistened by the acid mixture. At the end of about a minute or less add cold water to stop the reaction and wash the now nitrated cellulose thoroughly with fresh water. Dry the gun cotton in air *without heat.*

Collodion wool differs from gun cotton by

Make a solution of 40 grams of sodium hydroxide in 200 cubic centimeters of water.

being almost inexplosive. Its preparation also differs in that weaker nitric acid is used. Highly concentrated nitric acid and low temperatures are used in making gun cotton, while weak nitric acid and a temperature of from 50 to 70 degrees C. (122°-158° F.) is employed in preparing collodion wool.

Collodion wool is usually a mixture of tetra-nitro-cellulose and tri-nitrocellulose instead of hexanitrocellulose. A tetra-nitrocellulose is primarily obtained by mixing equal quantities of nitric and sulphuric acid (concentrated) and keeping the mixture at 50 degrees C. (122° F.). Then the cotton is added and left for 10 minutes. At the end of this time the acid is diluted with water to stop the reaction and the wool is washed with water.

A trinitrocellulose which contains a small quantity of tetra-nitro-cellulose is prepared by treating cotton for five minutes in a mixture of concentrated acids consisting of 4 cc of nitric acid and 5 cc of sulphuric acid

To the old solution add 100 grams of cotton by pressing the cotton firmly and strongly into the solution. Cover the flask or beaker and let stand for three days.

kept at a temperature of 65 degrees C. (149° F.).

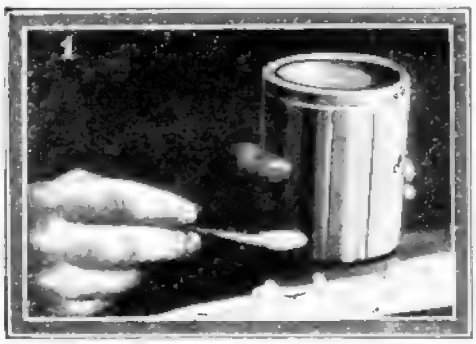
It is this collodion wool which is used in the manufacture of celluloid; the latter is obtained by incorporating camphor into

(*Continued on page* 379)

Stains and Stain Removers

By DR. ERNEST BADE

ALTHOUGH there are many ways to remove some stains, other stains can not wholly be removed. Stains on woodwork are very resistent and can often be only partially removed by bleaching and this bleaching process is only



Dark wood which is to be bleached is first treated by the application of a solution of chloride of lime in water. A thick paste of this mixture is applied and allowed to dry.

applied on that type of work which is stained in patches. One method uses three ounces of oxalic acid crystals in one part of warm water. Many stains will be removed or bleached, and then, too, this solution will remove ink marks from any surface as well as rust stains. It is very poisonous and sometimes it is not safe to use on fabrics.

Wood which has darkened can be bleached. At the same time it is also possible to bleach naturally dark lumber or unfinished furniture. It is a process not at all difficult Ordinary bleaching powder which is also known as chloride of lime, is mixed with water to form a thin paste. This is applied to the wood and allowed to dry. The dry paste is then moistened with dilute hydrochloric acid made by adding one part of the concentrated acid to three times its volume of water. Let it remain for a few hours, then clean the wood and if the bleaching has not been carried sufficiently far, repeat the process.

Old paints and varnishes on wood are often troublesome to remove. Liquids alone will often not take them off, burning off is not the best policy, scraping too often injures the work, therefore a combination of liquid softener and scraping must be resorted to for best all around use. Mix half a pint of water glass (sodium silicate) with two ounces of ammonia water. Dissolve a teaspoon of lye (sodium hydroxide) in an ounce of water and mix with the above solution. Brush this on varnish or paint which is to be removed and let it remain until the old covering has softened, then scrape it off and wash the woodwork with water. For delicate work scrape the wood with shavings.

It is an annoying habit to strike matches on

A surface from which paint is to be removed should be wet down and then scraped.

finished surfaces for unsightly marks and streaks are left every time a match is lighted. These marks are difficult to remove, especially when old. This bad habit can be prevented by rubbing the surface vigorously with a piece of flannel which contains a little, not too much, vaseline. The rubbing must be applied with pressure, and the vaseline must be worked into the finished surface. When the vaseline has been rubbed away, take a dry piece of flannel and again rub the surface thoroughly. So prepared, matches can not be struck on this surface.

Metals from which the varnish has been partially scraped or chipped, can be easily cleaned by dipping into a solution made by mixing equal quantities of ammonia water and denatured alcohol. If the article is too large to be dipped, brush it on with a soft brush. Keep the article moist until the varnish has softened, then wipe it clean with a rag.

The removal of stains and spots from fabrics is a different chapter. Fat spots on wool are cleaned with gasoline, ether or benzene. Try any of these first, if the spot is not removed try a different solvent, because one fat, which may not be soluble in benzol, will be more soluble in ether. When cleaning with these substances work near a window and keep at a distance from all open flames.

Fabrics with delicate colors stained with coffee or chocolate are readily cleaned by ap-

If vaseline is applied with considerable pressure to a finished surface, it will be found impossible to strike matches upon it. After applying, polish with dry flannel.

plying a drop or so of glycerine. Let it stand a minute or so and then wash off with water or alcohol.

Paint is removed by Turpentine or benzol.

Grass stains are removed by alcohol or ammonia.

Tar or wagon grease is removed by turpentine or benzol.

Ink is removed by solution of oxalic acid in water, or lemon juice. If the ink does not contain iron, try dilute acetic acid or strong vinegar. Green ink is bleached by ammonia. Many aniline inks are removed, although slowly, with alcohol, and nearly all of them with a solution of chlorinated lime followed with a wash in dilute acetic acid.

Rust is removed with oxalic acid in water.

Mildew may be removed by soaking in sour or sweet milk over night.

For cleaning glass vessels such as flasks, etc., without leaving a stain, make a mixture of ten parts of water, one part of potassium bichromate and four parts of sulphuric acid. This solution may be used over and over again until a greenish tinge is given to it.

Oil stains on marble and tile may be removed by incorporating benzol with clay and applying this to the stained parts in a thick paste and leaving it on until the oil is absorbed.

Leather articles are very apt to get spotted in various ways with the result that the articles become very unsightly. The usual method of removing fatty spots cannot be employed for the solvents of fats only spread the fat over a greater area, making the ap-

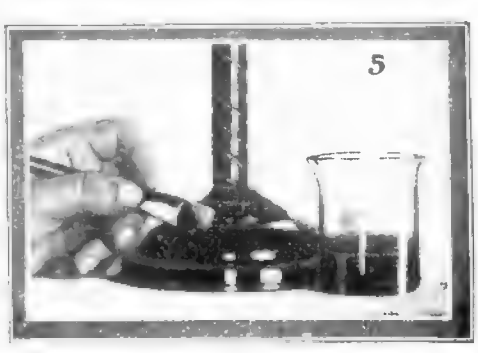
The dry paste is then moistened with dilute hydrochloric acid, one part HCl in three parts of water. Let it stand for a few hours, then clean the wood and repeat if necessary.

pearance of the object more objectionable. A method has recently been developed whereby the spot is coated with a thick solution of rubber in a solvent that readily evaporates. Then, when the film of dried rubber is removed, the spot will be removed with the film of rubber. One application will usually be sufficient, although it does frequently happen that two or more trials must be used before the spot is entirely removed. Some of the prepared rubber cements on the market may be used for this purpose and, if desired, a solution may be made by dissolving one part of Para or Ceylon unvulcanized rubber in ten parts of carbon bisulphide. To keep the rubber from adhering too tightly to the leather, the leather surrounding the spot is slightly moistened with water. In this connection it must also be stated that all stains cannot be removed, this method is only effective under certain conditions. The spot should not be too old and the cement must be quite thick in order to be effective.

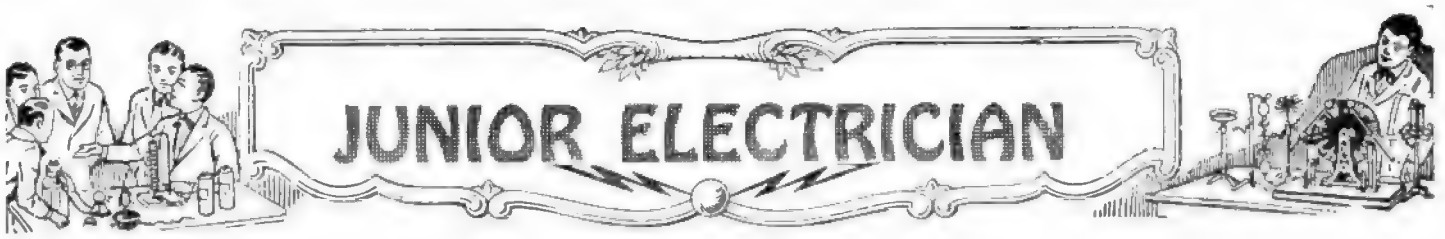
When paint or varnish has dried and hardened its removal is more difficult. In many cases the best plan is to buy some paint remover, which is now made of most efficient action.

A simple method recommended by some authorities is to wash in strong ammonia water the goods on which paint had dried. An emulsion or mixture of turpentine, 1 part and ammonia water, 2 parts (both by measure) has been recommended.

Tracing cloth used by draftsmen is cleaned of spots by benzine applied with a rag. It will not interfere with India ink drawings. Before use the cloth may be dusted over with talcum powder.

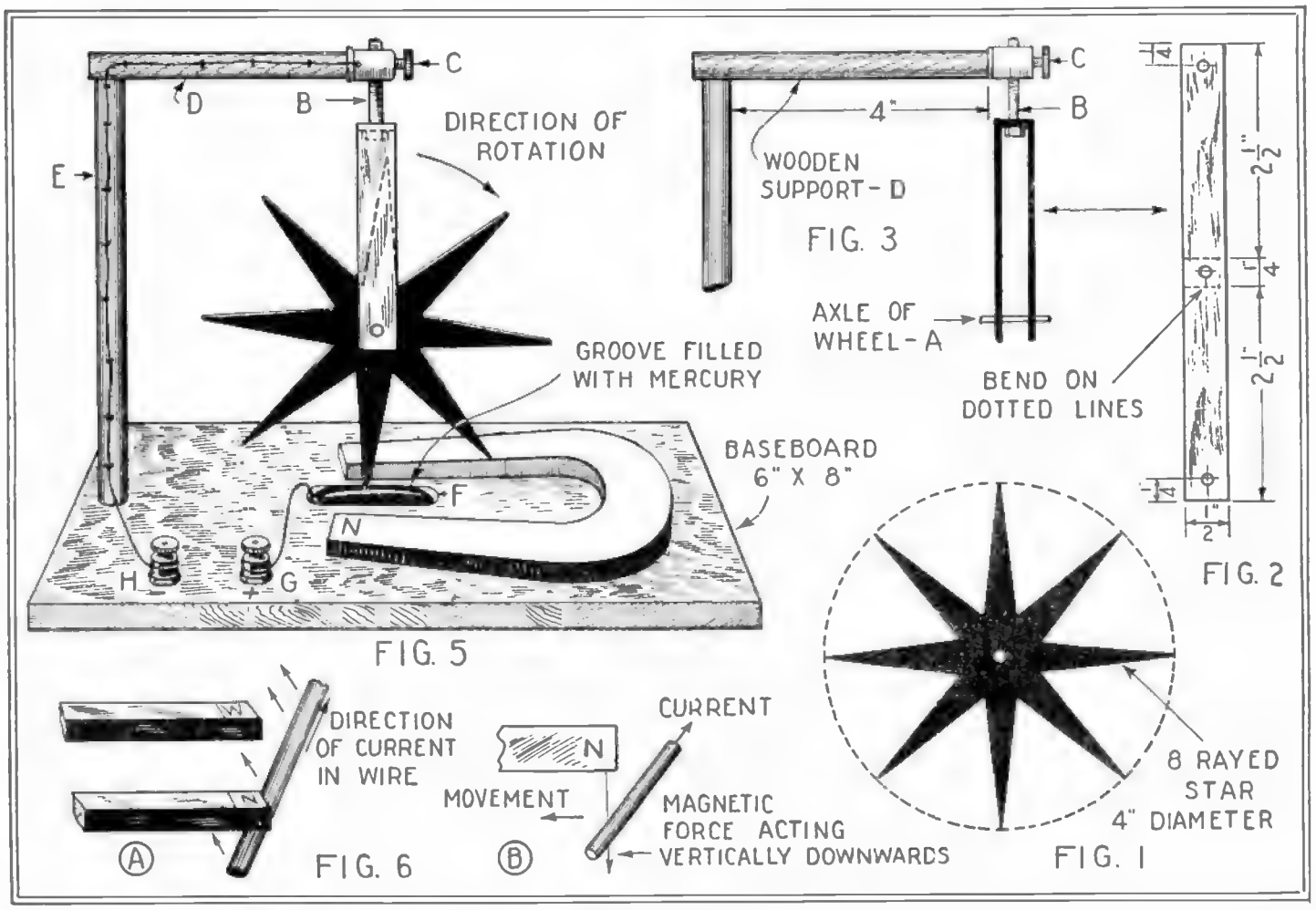


A mixture of equal quantities of ammonium hydroxide and denatured alcohol will remove paint from metal surfaces.



Barlow's Wheel

By G. H. FRAZER



This is a very good presentation of the classic experiment of Barlow's wheel, which is a variation on the classic Faraday's wheel. It constitutes a motor and should be constructed very nicely to avoid friction because the power which it can exert is very slight. It is quite instructive as illustrating the relation between electro-magnetic lines of force and the electric current. The theory of its action is explained in diagram.

A BARLOW'S Wheel is quite a simple piece of apparatus to make, and gives a good illustration of "Ampère's Rule." It is a very simple form of electric motor. It consists of an eight-rayed star which revolves so that its points pass through a small trough of mercury. The star and the mercury are connected to the poles of an electric battery, and the poles of a horse-shoe magnet lie on each side of the trough, as shown in the sketch.

Figure 3 shows the star, or wheel, which has a total diameter of 4", the rays being cut to within ½" of the centre. Through the centre a hole is bored. The support is illustrated in 2 and 3, cut and bent as shown, fitting an axle for the wheel at A. By means of the rod B and the binding post C the support may be raised or lowered in order to adjust the wheel. C is of the wood-screw type and is fixed into a wooden support D, which is carried horizontally by the vertical rod E.

The base board lay-out shown in 5 F is merely a small groove hollowed out in the board and filled with mercury; into this a wire dips and connects it to the positive terminal G. The negative terminal H is connected to the wheel by a wire soldered to C. Sketch 5 shows the completed instrument.

The apparatus may be made from any available scrap, such as the radio experimenter will possess. Copper may be used for the support, but if copper is used for the wheel the latter should be withdrawn after use to prevent corrosion by the mercury; this can be prevented by using thin iron for the wheel.

If about 6 volts be connected to the binding-posts, G, H, the north pole of the magnet being the nearest, the wheel will revolve in a clockwise direction. (Caution: If you use accumulators insert a suitable resistance, *e. g.*, a tube rheostat, or you will practically short-circuit your battery.)

The explanation of this rotation lies in Ampère's Rule, referred to above. This is illustrated in sketch 6. Ampère said, "Imagine that you are looking at a wire carrying an electric current, and that it is free to move in a magnetic field; then if you face along the direction of magnetic force, *i. e.*, turn your back on the North pole producing the field, the wire will be carried towards your left."

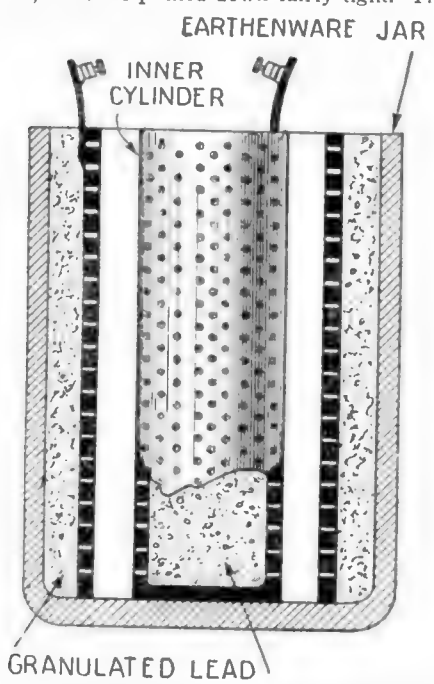
In Barlow's Wheel if we look in the direction GF we are facing along the lines of magnetic force, and, therefore, each point of the star as it touches the mercury is carried to the left, rotating the wheel clockwise.

The principle of a wire's movement in a magnetic field, regulated by the above rule, is the basis of every electric motor running.

A HOME-MADE STORAGE BATTERY

The following describes a thoroughly practical accumulator, one of whose advantages is that there are no plates that buckle and drop their coating so as to short circuit the cell. An earthenware jar is suggested as the container. Here it is to be remembered that all earthenware jars are not absolutely acid-proof. Thus a marmelade jar will often be found to permit a certain amount of acid to reach its outside surface, carrying salts with it. Two lead cylinders are now to be made. The lead should be about 4 pounds to the square foot gauge. The plates for

the cylinder are punched full of holes and the edges are brought together and a strip of lead 1 inch wide and a couple of inches longer than the height of the cylinder is burned to them by a hydrogen flame or is secured with lead wire rivets. The strip which projects above the edge gives a good connection for the line wires. The inner cylinder is of such diameter as to provide about ⅜ths of an inch space between itself and the outer one. This inner cylinder has a plate of lead for a bottom which can be secured by hammering the edge of the lead cylinder over it, and this may be advantageously secured also by autogenous soldering with the hydrogen flame. Plenty of scrap lead is now to be granulated; it is melted in a ladle and poured into water from a height of 5 to 6 feet. The space outside of the outer lead cylinder and the interior of the cup are both to be filled with the granulated lead, which is packed down fairly tight. The



A view partly in section of a storage battery, in which granulated lead provides a very large area of active surface for both positive and negative elements of the cell. This use of granulated lead is quite characteristic.

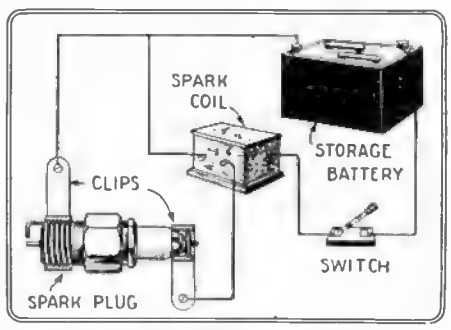
upper edge of the cup is then closed with a perforated disk of lead, just as was the bottom. Strips of wood are used to go between the lead cup and the outer cylinder to prevent short circuiting. The wood should be ⅜ths of an inch square in section and should be immersed in hot paraffin for some time before it is used.

By charging once, even without the forming process being applied, a considerable discharge will be gotten from the battery. It does not matter which element is taken as positive and which as negative, but once that it is charged, no interchange is allowable.

The author states that for a number of years he used a set of 36 of these cells for lighting his work shop. They supplied a 16-candle-power incandescent lamp. The jars were hidden in square boxes which were filled with pitch melted in. For testing purposes, a current as high as 200 amperes and a potential of over 70 volts were taken from the battery.

Testing Spark Plugs

IT sometimes seems that too little attention is paid by automobilists to their spark plugs. The good or bad condition of these has a great influence upon the power of the engine. For minute as the spark is, its variation in intensity makes a great difference in the force of the explosion. The illustration shows a simple arrangement for testing. It speaks for itself. Connecting a Ford coil with its three terminals as shown, the plug is connected by special clips to save trouble and time and the secondary of the coil is connected as shown so as to produce a spark when the switch is closed. The great point is to have all the connections very good. It is even advisable to solder the wire to the spark coil. After a little work on different plugs, the eye will learn to discern a good plug from a bad one by observing the appearance of the spark and the work can be done very rapidly. Sometimes on cleaning a spark plug a good spark will be produced. If cleaning does not improve it, a new porcelain should be obtained or the plug may be thrown away.—*Harry E. Hudec.*



A simple set-up using a Ford coil and a storage battery for testing the condition of spark plugs. The appearance of the spark tells the story, and after some experience the work can be done very rapidly.

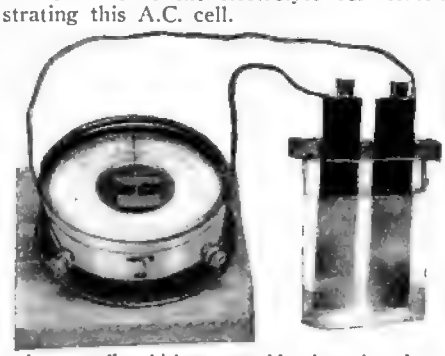
A Wet Cell Which Produces an Alternating Current

By RAYMOND B. WAILES

ONE usually associates a dry or wet cell with direct current. Here is a wet cell which will give an honest-to-goodness alternating current. The frequency is about one cycle every three seconds.

Beat out two strips of copper sheet with a hammer until they have been reduced in thickness and become somewhat springy. Mount them upon a wooden strip so that they can be immersed in a solution in a battery jar. A cut off bottle, half or full pint size, makes a nice little cell. Solder Fahnestock type binding posts to their ends so that connections can be made to the indicating instrument which may be a millivoltmeter, milliammeter, galvanometer, electrometer, etc.

The electrolyte is a mixture of nitric acid, hydrochloric acid and water. About 25cc of concentrated nitric acid, 10cc of concentrated hydrochloric acid and 70cc of water makes an excellent electrolyte for demonstrating this A.C. cell.



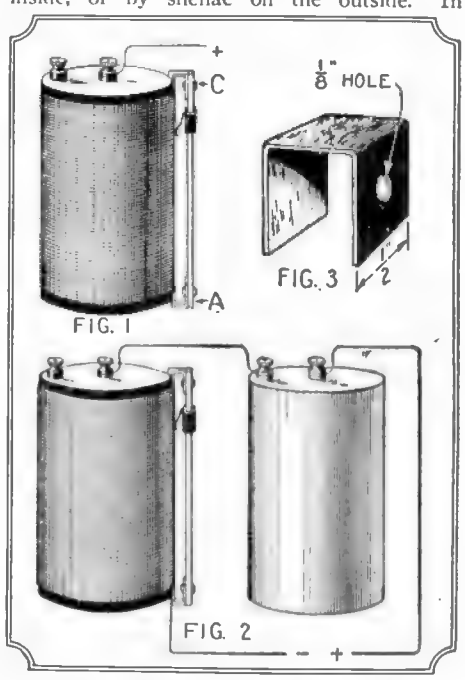
A wet cell, which presumably through polarization produces a current first in one direction and then in the other; it only gives one-tenth of a volt, but is an interesting electric curiosity.

Immerse the strips and wait until the plates "form," whence the current will be set up, first flowing in one direction and then the other. It is best in this simple and mysterious experiment to use an instrument which has its needle or pointer midway in the scale, or with its zero in the center of the scale, so that the hand will sway back and forth in response to the different directions which the current is taking. About 0.1 volt can be gotten from the cell, the amperage depending upon the size of the plates.

Wire Rheostat

By DAVID ROTBART

THE rheostat shown in the illustration is very simply constructed. A coil of wire to give the resistance is wound on the pasteboard case of an ordinary dry cell. As the case is not very strong, it is well to leave the cell within it while doing the winding to prevent it from collapsing. Cotton-covered wire or bare wire may be used, but in either case cord should be wound on with the wire so as to space it evenly. One-fourth of an inch of the pasteboard case at each end should be left bare and the end of the wire may be secured by shellacking a heavy piece of paper over the last few turns, or with a needle and thread it can be stitched to the pasteboard, after removing the cell. The pasteboard may be stiffened by giving it a good coating of glue on the inside, or by shellac on the outside. In



In this rheostat a sliding contact is provided which cuts in more or less of the turns of the wire, thus modifying the resistance; it can be constructed so as to give very delicate modulations.

using glue, get solid carpenter's glue, or solid fish glue and soften it in a double saucepan with hot water, if you haven't a glue pot on hand. A heavy wire or tin strip is supported by two little metal pieces from top to bottom of the case, as shown in Fig. 3. The upper one is in metallic contact with the upper end of the resistance wire, the lower one is insulated therefrom.

A little slider carrying one end of a spring or hard drawn wire can be slid up and down the vertical rod or strip and the layers of wire in its path must have the insulation scraped off if such wire is used, so that the spring terminal under the little slide can make good electrical contact with turn after turn of the wire as it is slid upward or downward. It will be seen that as it slides down, it will bring more and more wire into the circuit, and the reverse obtains when it is moved upwards.

In one of the illustrations the connections are shown. One end of the wire of the outer circuit is connected with the bottom of the vertical rod and the other end is connected with the upper end of the wire of the coil.

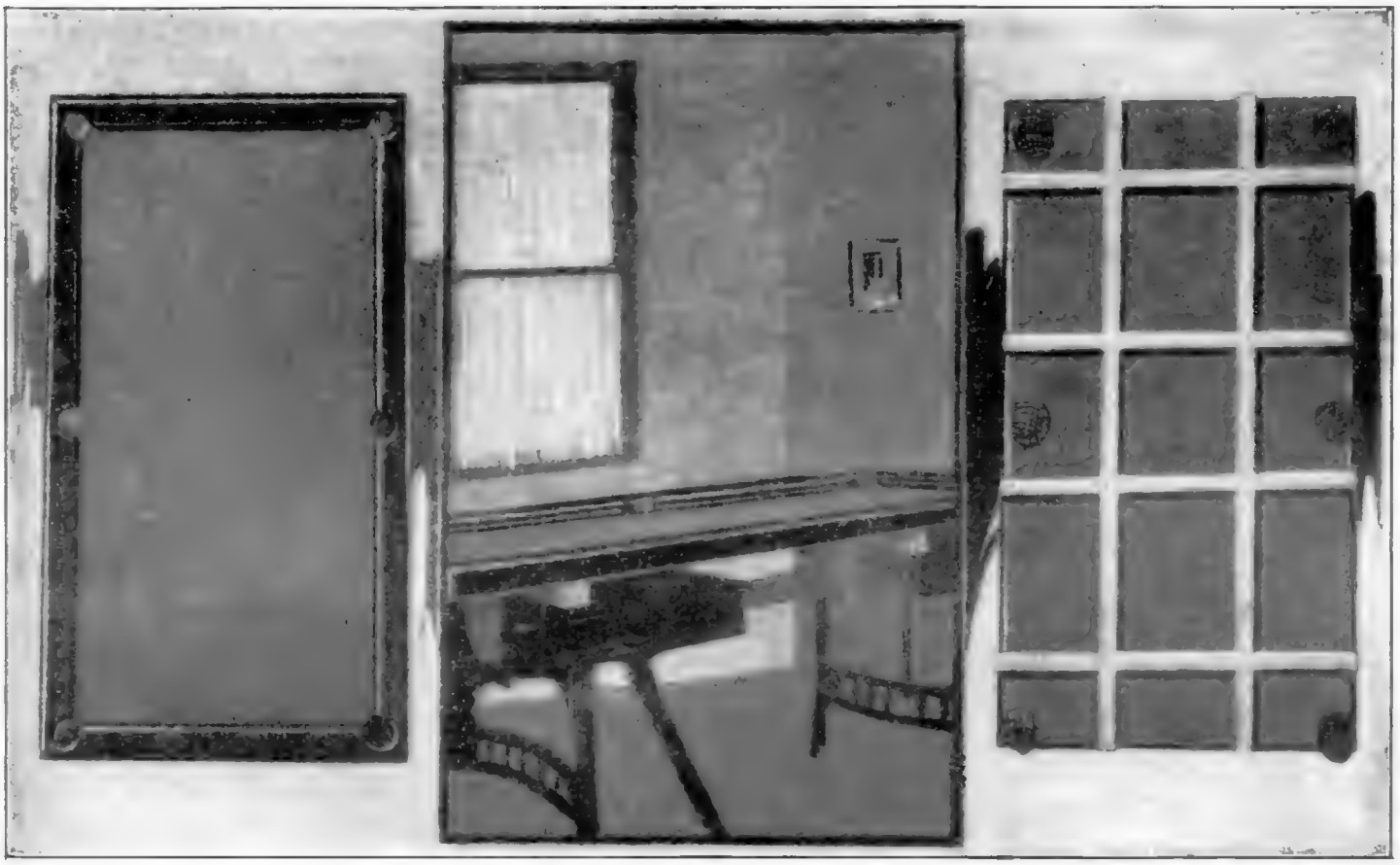
It will be seen, therefore, that the little spring that rubs against the wire on the coil beneath the vertical rod really becomes one of the terminals of the circuit.

THE CONSTRUCTOR

Articles of Interest to the Home Mechanic

Making a Billiard Table

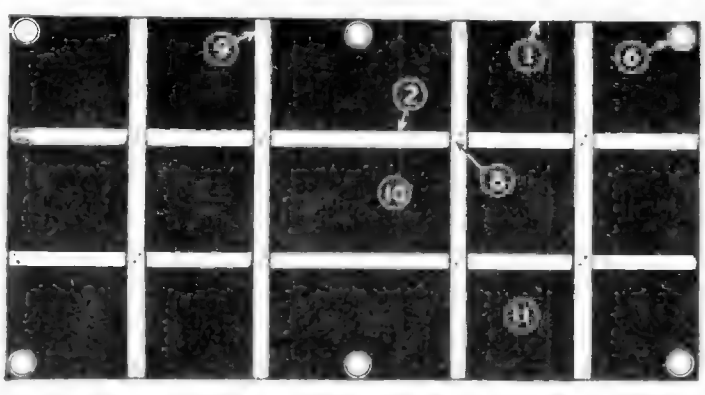
A Home-Made Billiard Table Which May be Built at Nominal Cost



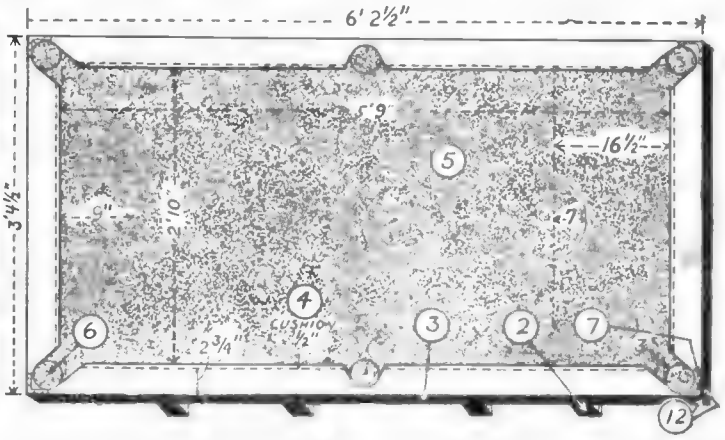
Above we have a front view of the completed billiard table. Note the neatness of the construction and also how smoothly the author has attached the cloth to the frame.

The center photograph shows the table set-up and ready for use. The photo above gives a view of the back of the table. Note the supporting strips which are arranged across the back.

THE accompanying photos and sketches show how easy it is to build a practical table that will give many evenings entertainment. The cost should not be over $10.00. The top frame No. 3 should be made first, the two ends and sides are then assembled temporarily. The frame is held together with a few nails so that the shape of the pockets on the frame may be marked out. After the corners have been cut out the frame can be assembled and metal corner braces No. 7 can be used. Next the under or bottom frame No. 2 is cut out. The bottom frame is made as shown in the sketch and photo. The finished table should be covered with billiard cloth. Use the glue sparingly over two feet at a time and brush out the creases with a cold flat iron. Next nail the cushions in place and adjust them to the proper height to correspond with the sizes of the balls used.—*J. S. Hill.*



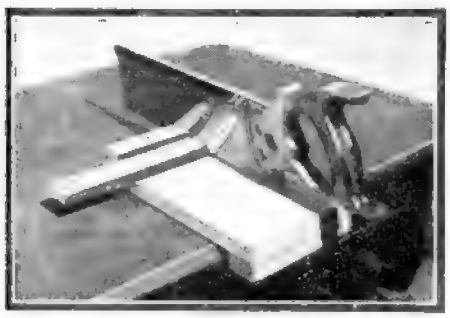
A bottom view of the table is shown above. Note the placement of the frame which consists of six pieces of birch, four of which are 4 feet long and the other two pieces 7 feet in length.



Above the constructional details of the front frame of the table are given, together with the necessary dimensions. The rear frame is designated by No. 2 and metal braces by No. 7.

HINTS FOR THE MECHANIC

Bench Hook — First Prize $10

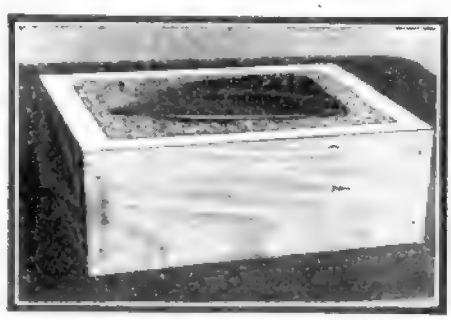


To avoid marring the kitchen table on which much shop work is usually done, a bench hook can be used to advantage. Its use is shown in the photograph.—Raymond B. Wailes.

V-Board Rest

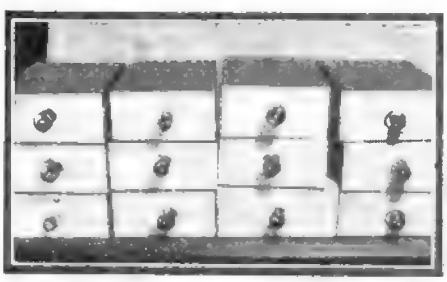
For filing, polishing, or trimming machined parts, a V-board makes an ideal rest. In the illustration above it is fastened to the table top with a C clamp.

Sad Iron Anvil



A small anvil for the experimenter may be constructed by imbedding an old sad iron in a box of sand. The sand serves to reduce the jarr resulting from hammering, and cuts down noise.

Cigar Box Drawers



Cigar boxes with pot knobs attached as handles make handy containers for loose bolts, etc., and for small tools.

A New Department!

BEGINNING with the May number we started this new department—"Hints For the Mechanic," in which we intend to publish wrinkles useful to mechanics in general. You can help us with this department by writing a brief description of your favorite shop wrinkle and sending this to the editor of this department, together with a pencil or pen and ink sketch of the wrinkle. The ideas published herewith will give you some idea of what we want. Our draughtsmen will make the necessary mechanical drawings, so you need not send us finished drawings. We will pay $10.00 each month for the best Wrinkle or Hint sent in; others published will be paid for at space rates. Address all letters to Editor, Hints For the Mechanic Dept., in care of this magazine.

Marking Crucibles

Amateur chemists can identify crucibles by writing upon them with ordinary ink and after drying heating them red hot.

Dropping Bottle

A dropping bottle made from a flask and a drawn out length of glass tubing or a medicine dropper, makes an efficient applicator for liquids, when only a few drops are required at a time.

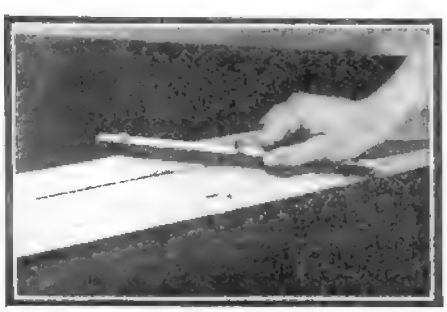
Cutting Glass Tubing

To cut large diameters of glass tubing, make a deep scratch with a file and then apply the pointed end of a red hot glass rod at the point where the fracture is desired. Be sure that the tubing is dry.

Simple Bench Stop

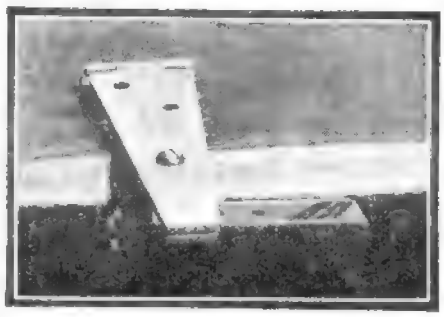
For planing upon the work table, use a simple bench stop as shown. It is constructed from two machine bolts with butterfly heads, screwed through the table top. They can be easily removed when not desired.

Center Gauge



The instrument known as a center gauge may be used to mark the center line of any board which it is necessary to bisect. By turning the device at an angle, any board within its size may be marked.

Novel Vise

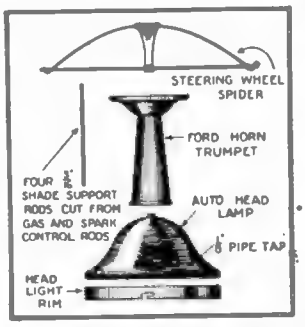


An improvised vise to hold small parts may be made from a door hinge screwed to the table top and clamped with a machine bolt. The inside of the jaws of this vise should be roughened or corrugated.

HOW TO MAKE IT

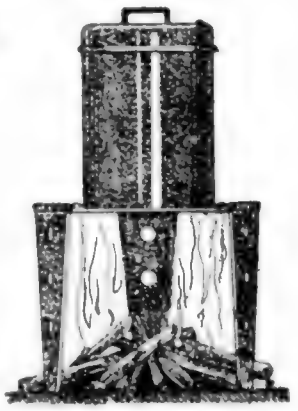
AUTOMOBILE TABLE LAMP

The completed lamp is shown in the photograph appearing above. Note that the wires leading to the electric light socket have been brought out close to the base of the lamp. The method of supporting the bulb and shade holder should also be observed.


STEERING WHEEL SPIDER
FORD HORN TRUMPET
FOUR ⅜" SHADE SUPPORT RODS CUT FROM GAS AND SPARK CONTROL RODS
AUTO HEAD LAMP
⅛" PIPE TAP
HEAD LIGHT RIM

A sketch of the auto lamp showing the various parts used in its construction, is given above. The shade holder is made from an old steering wheel spider and is supported by four rods which are cut from the gas and spark control rods. The pedestal portion is fashioned from a Ford horn trumpet. An auto head lamp serves as the base and a headlight rim attached to the base completes the lamp. A ⅛" pipe tap in the base of the lamp provides for the introduction of the wires supplying the current. The various parts of the lamp are soldered together and the whole may then be artistically finished.

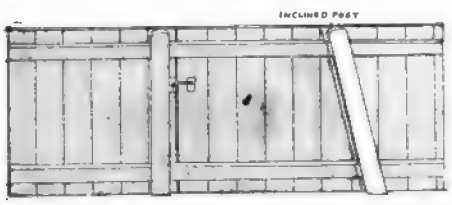
FOLDING CAMP STOVE



Two views of the camp stove are shown above and also to the right. Three large hinges are riveted to a round piece of iron and the whole may be folded up.

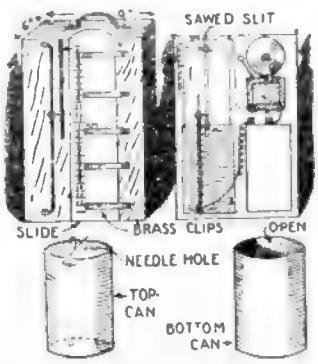
TO be of real service a camp stove should be of such a nature that it can be packed away into a small space. In the sketches there is pictured a stove which comes very near to being the ideal. The main part of the stove is a round piece of sheet iron which is about 2 feet in diameter. Three large hinges are riveted around the edge in the manner indicated. Holes are punched in the round plate to allow the passage of heat from the fire to the food being cooked. When not in use the hinges may be folded up.—S. Leonard Bastin.

SELF-CLOSING GATE



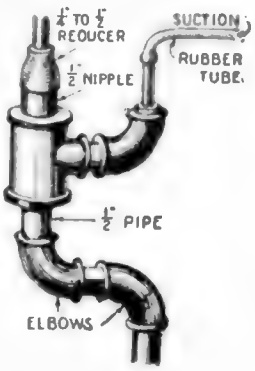
By constructing a gate in the shape as shown in the illustration and hanging it from an inclined post, it will close itself without weights or springs. The weight of the gate closes it upon being released.—Robert L. Streeter.

NOVEL CLOCK AND ALARM



Water clocks have been used for many purposes. At the right we we have a diagram of an unusual clock and alarm. The hour markings should be made by experiment. In setting the alarm, the can is released from its hook into the liquid and the guide contact pointer is set, by moving the cardboard slide. The thumb screw pointer should be set at the time the alarm is required to ring.—W. A. Farrell.

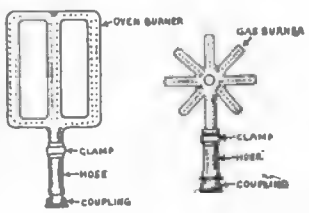
SIPHONING APPARATUS



By arranging several pieces of pipe as shown in the accompanying diagram, an efficient siphoning apparatus can be made. Suction is applied at the rubber tube and results in the drawing down of the liquid, thus starting the siphon. Where large quantities of liquids are to be transferred from one vessel to another this arrangement should prove to be ideal.—J. H. Byers.

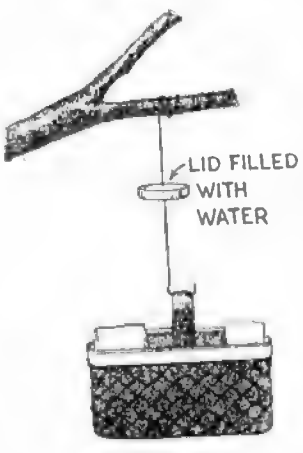
LAWN SPRINKLER

Illustrated here we have two sketches which show two types of burners which may be used as lawn sprinklers.



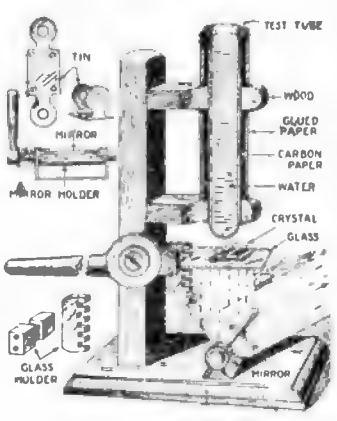
The hose and coupling serve to connect the sprinkler with an ordinary hose.—S. Badalamente.

INSECTLESS FOOD BASKET



Ants and other creeping insects are very likely to find their way into food which is kept about the camp. This may be prevented by resorting to the novel means made clear in the diagram. A tin can lid is soldered to a piece of stout wire so that a water tight joint is secured. One end of the wire is bent in the form of a hook to hold the basket. The lid is filled with water and the insects are drowned. — S. Leonard Bastin.

SIMPLE MICROSCOPE



A cheap microscope for observing crystals may be made from one of your test tubes. The details of the microscope may be obtained from the illustration. The tube is filled with water and acts as a magnifying lens. The longer the tube the greater will be the magnifying power. — Edgar Spaulding.

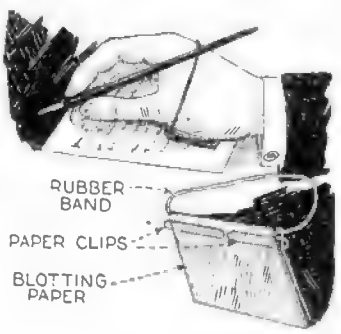
WRINKLES
RECIPES & FORMULAS

Edited by S. Gernsback

BOOK COVER PRESERVATIVE

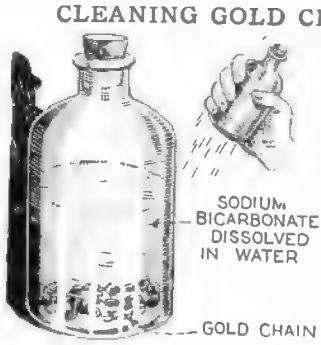
The covers of books may be preserved by giving them a coat of white shellac. When dry the cover is rubbed with furniture wax and polished. —E. L. Dunbar, Rep. No. 28789.

HANDY BLOTTER



An efficient blotter can be easily constructed by folding the blotter in half and putting an elastic band in the fold. The band is held in place by two clips and the blotter is worn upon the wrist. —Arthur Leventhal.

CLEANING GOLD CHAINS



Gold chains may be cleaned very easily by putting them into a bottle containing a solution of sodium bicarbonate—G. Mazaretian, Rep. No. 25518.

SIMPLE "NOISE-MAKER"

A "noise-maker" for any celebration may be readily constructed from a key, a nail and a piece of string. —Albert Kosloff.

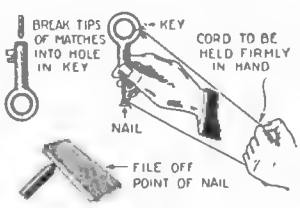
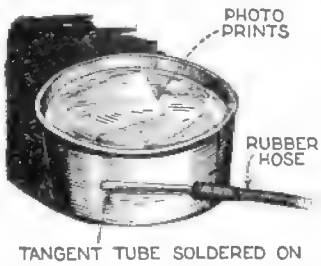


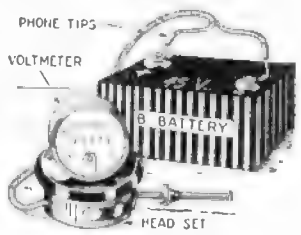
PHOTO PRINT WASHER

A straight sided pan, with a tube soldered on about a third of the way from the bottom, makes an excellent print washer. Vent holes are arranged round the top of the pan. —Richard Bannerot.

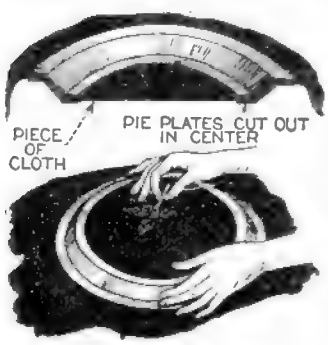


TESTING PHONE POLARITY

A voltmeter placed upon the cap of an ear phone, the tips of which are touched to a "B" battery, will show the polarity of the phone. — Juan J. Gomez.

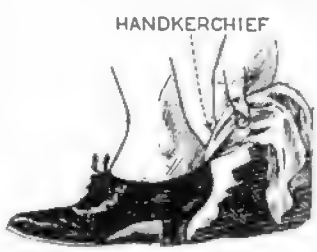


KITCHEN STRAINER



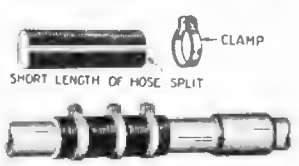
A piece of cloth, placed between two pie plates, the bottoms of which have been removed, makes an excellent strainer for kitchen use. The cloth should be thin and it is recommended that a piece of cheese cloth be used for the strainer.—James Kish.

IMPROVISED SHOE HORN



A tight shoe can be easily put on with a handkerchief or piece of cloth when no shoe horn is available. About 2½" of the cloth is placed in back of the shoe and the foot is placed in as far as possible.—Sidney Lang.

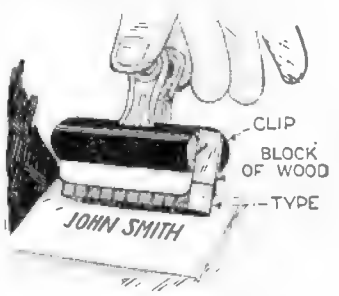
PIPE REPAIR



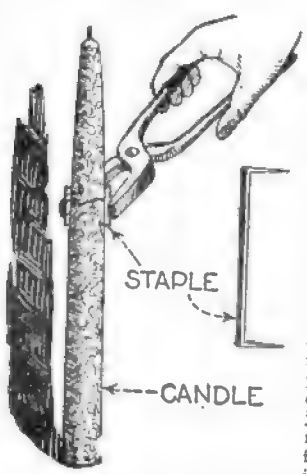
A piece of garden hose clamped over the leak in a pipe will make a very satisfactory repair. —F. Johnson.

EMERGENCY STAMPER

A letter clip, with a block of wood the same thickness as the type, will come down far enough to support the type and yet keep it from slipping in further. The type will then project out far enough so that it may be used. —Robert Kenyon.



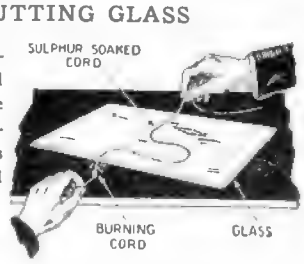
MENDING BROKEN CANDLES



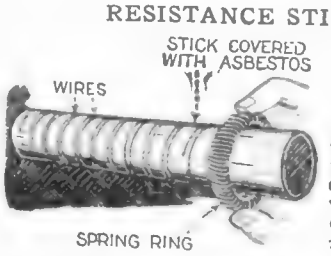
Broken candles may be effectively joined by using two or three wide staples. The staples should be heated and pushed into the candles while they are still warm. A little heat applied at the break will cover the joint and the candle will be as good as new. This method of repair affords a clean and neat joint and does not show the fusion plainly as is the case when the two ends are held together and simply heated. If staples are not available short pieces of stiff wire may be used in their stead—L. A. Heinle.

CUTTING GLASS

A piece of sulphur dipped cord is laid upon the surface and ignited. The glass is then dipped into water. —J. Shupienis.

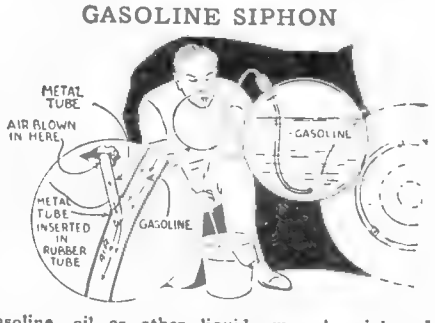


RESISTANCE STICK



A piece of broom stick, covered with asbestos and then wound with two strands of iron wire of the required size will make an excellent resistance. A spring is slipped over the broom handle and is adjusted to change the resistance. These resistance sticks can be made so cheaply that one can be had for each current requirement.—Gordon Roda.

GASOLINE SIPHON



Gasoline, oil or other liquids may be siphoned by using a combination of a rubber and a metal tube. The rubber tube should have a diameter of about ⅜" and the metal tube should be slightly smaller. The accompanying diagram will show the operation of this siphon. Air is blown into the metal tube.—Joe Fuhringer.

SCIENCE AND INVENTION desires to hear from its readers. It solicits comments of general scientific interest, and will appreciate opinions on science subjects. The arguments pro and con will be aired on this page. This magazine also relishes criticisms, and will present them in both palatable and unpalatable forms. So if you have anything to say, this is the place to say it. Please limit your letters to 500 words and address your letters to Editor—The Readers Forum, c/o Science and Invention Magazine, 230 Fifth Avenue, New York City.

LIFTING STUNT

Editor, SCIENCE AND INVENTION:

Some time ago I was shown the trick of lifting a person on the finger-tips. The subject was seated in a chair and four persons gathered round, placing the tips of their fingers under the arm-pits and knees of the subject. When and only when we breathed together and performed certain other antics according to definite specified rules, did the subject rise in the air with apparently no effort on our part whatsoever. The pressure on my fingers seemed practically nothing.

When I took my place as the subject, I rose into the air with the most startling sensation. I felt no pressure under my arm-pits or under my knees.

The experiment fascinates me. Can you explain it, fully and completely?

LALE C. ANDREWS.
Kansas City, Mo.

(The explanation of the stunt which you have described is quite simple. If you were a person weighing 200 pounds and you seated yourself in a chair and four other persons placed the tips of their fingers under your arm-pits and under your knees, then your weight would be distributed equally among these four people. Each person would then have to lift a weight of 50 pounds which can easily be done when but one finger is used. Breathing together and other antics have no effect whatever on the experiment, the only prerequisite being that all four persons lift simultaneously. In this way you feel no pressure, or but very little pressure. Only one-quarter of your weight is being lifted at any one of the points of contact. You will find that very heavy people can be lifted with ease in the manner described by you. The "Georgia Magnet" and other performers claiming to possess some uncanny power which holds them riveted to the ground, cannot be lifted in the manner described by you because they permit their muscles to relax completely. Their shoulders then act as a fulcrum and when one person on the right side is trying to lift, flacidness of the muscles relay the lifting stress directly to the person on the opposite side and the forces oppose each other. In even such experiments, there is little scientific knowledge required to demonstrate the effect.—EDITOR.)

PERPETUAL MOTION

Editor, SCIENCE AND INVENTION:

I would like to make a comment on your offer of $5,000 for a model of a perpetual motion machine. In the first place, I think that you are playing a pretty safe game. If a person had in his possession the construction and assemblage of parts that when put in motion, would continue to operate, I think that he would want more than you would offer. The first thing any man would do if he knew anything at all, would be to get his construction patented. After that he would have to get it promoted.

To my way of thinking, perpetual motion would not be hailed as such a great thing. Look back on some of the inventions that have come into vogue during the last forty years. I can remember when the first phonograph was put before the public, crowds went to see and hear the wonderful talking machine. Could you get a crowd to pay money now to go to the show to hear a phonograph? I guess not. Phonographs can now be found in the attic. I can also remember when a man who had a bicycle was considered a very well-to-do man. Now all the newspaper boys in the country have them. Think of the wireless, then the radio, and pretty soon we will have movies with the radio. These things are far more complicated than perpetual motion.

That nothing will be impossible to man before he gets through with this earth, that some man somewhere has the secret of perpetual motion in his head is a fact, but said gentry is not in a mood for developing his idea or has not money enough to go ahead with this desperate idea. It takes time and money and lots of patience to develop an idea. I might venture to say that I have an idea of my own on that subject, but I have not put it into practice and I don't think it would cost much to make it. But one has to be in a very personal mood to get at those kinds of things. Perhaps I may tackle it some day if I am not too late.

I think that we have lost out terribly on aviation. While there were wonderful things done with the airplane in the last war and let us hope it is the last, to my own way of thinking the airplane is of little commercial value. An air pilot has to be a daredevil and an aerial acrobat, and we are not all inclined that way. An aerial machine should be safe for any one of ordinary intelligence to use to be of real commercial value. To my way of thinking, the real commercial flying machine will be a combination of the helicopter and the gas bag, then you could start off slow and the handling of such a thing could be made easier and safer. This racket of being shot off into the air at a 30 mile clip does not appeal to the average commuter, and woe be to the man who does not know his stuff.

Hoping that you will have that $5,000 ready if I make a success at perpetual motion, I will now close with kind regards.

WM. NEWENHAM,
Oakland, Calif.

AMAZING STORIES

IN OUR AUGUST ISSUE:

THE WAR OF THE WORLDS, by H. G. Wells (a serial in 2 parts) Part I. In his characteristic manner, this famous author of scientifiction, gives us a vital, fast-moving story about a not too impossible attack upon the Earth by Martians sometime in the future. He gives us some strange and astounding ideas about the Martians, their means and methods, of warfare, and adds to the realism and picturesqueness of the story by his vivid descriptions of well-known localities in England.

THE TISSUE-CULTURE KING, by Julian Huxley, grandson of the famous English scientist, Thomas Henry Huxley, and himself Professor of Zoology in Kings College, London, gives us a remarkable story of unusual interest—an assortment of science and adventure in Africa, which you would never believe possible.

THE ULTRA-ELIXIR OF YOUTH, by A. Hyatt Verrill, in which a scientist in search of the Elixir of Youth, far exceeds his wildest expectations. The startling results which follow and the unprecedented end only make the story more complicated and absorbing. It is a picturesque tale of the biological possibilities in the field of modern science.

THE RETREAT TO MARS, by Cecil B. White. The discovery of a complete Martian library in a cave in Africa furnishes this leading author-astronomer of the West ample opportunity to tell an absorbing story of vivid detail about Martians. The mathematics contained in the story only add to its vraisemblance. This is an unusual story, excellently told.

THE CHEMICAL MAGNET, by Victor Thaddeus. The suggestions of what chemistry in the future may yet accomplish is largely responsible for the atmosphere of sober reality which pervades this rather wonderful story. We know that the ocean contains gold in enormous quantities. Why not extract it?

THE SHADOW ON THE SPARK, by Edward S. Sears. To possess perfect health and a robust physique, does not mean that death from shock is impossible. On the other hand, if such a person dies, apparently from the effect of an operation for the amputation of a leg, some suspicion as to the real cause of his death is justifiable. Our new author weaves his science through this unusual murder story in a thoroughly ingenious manner.

(We have repeatedly stated that SCIENCE AND INVENTION *Magazine is not interested in the rights to any perpetual motion machine which might be developed. We think that an award of $5,000 for merely watching a machine operate is quite a substantial sum. The award is not made with the intention of paying the inventor for what service he has rendered. It is not made for any particular benefits which this publication might derive other than the benefits of being permitted to publish an article on the discovery. But the award will more than pay for the financing of any patents which a poor inventor may be otherwise unable to finance.*

Your statement to the effect that nothing will be impossible to man is quite tenable. If the $5,000 award which we are making for a perpetual motion device will in any way advance man's knowledge in the scientific field, we will feel that we have done at least a little for the progress of human kind.

We also agree that the modern airplane is not as good as it will be eventually. We do not hold that a balloon and helicopter will take the place of the airplane, because a balloon is very unsatisfactory and until we are able to control the weather, a large vessel of this nature is entirely at the mercy of the forces. Perhaps even the helicopter is not the ultimate type of airplane. It may be that the future airplane will be suspended in air purely by its speed of travel and by the reaction of gases escaping from the tail and from the body of the gliding vessel. It is quite possible to conceive that a rocket type of airplane fitted perhaps with a parachute-like forced landing device would enable greater speed, greater safety and would limit the number of airplane accidents. Ordinary landing might be made by reacting gases. The motive power could be in duplicate or triplicate so that in event one of the gas discharging tubes failed, the others would automatically drop into service.

We shall be ready with the $5,000 award when you demonstrate your working model of a perpetual motion device. This offer likewise holds true for any other perpetual motion inventor.—EDITOR.)

MENTAL TELEPATHY

Editor, SCIENCE AND INVENTION:

I am writing you concerning what I believe to be a case, on my part, of mental telepathy.

I am a radio amateur, and invented for my own amusement many little devices of a mechanical or electrical nature. I am beginning seriously to doubt whether I am inventing them or whether I am merely getting the idea from someone else.

For instance, one spring morning a year ago I thought to use a condenser for a microphone, to be used in a broadcast outfit. The circuit was to comprise a tiny condenser, whose plates were to be actuated by sound waves, an oscillator and an amplifier. The idea came to me quite suddenly without any effort on my part, stayed a couple of days and left. I jotted it down in my scrap book, and there it stayed for a time. A month ago it reoccurred to me quite forcibly when I was engaged in radiophone experimental work. It came out in RADIO NEWS for April. I believe I never originated that idea at all, but got it from someone else. Behold the reason of the patent squabbles over the regenerative circuit, the vacuum tube, etc. One person thought of something new, and the other picked it up. They both worked forward and settled in court.

Time and again this kind of an occurrence such as I have related has taken place with me and it has gotten to be a system with me. I jot down the date beside a new idea, and say, "This thing will come out in about two months." I am never more than a month out in my guess. Maybe the author's work missed the first month's issue, and so I received the idea a month ahead of publication.

I also got the idea of "heterodyning" light waves to make objects invisible, and I fancied a story for AMAZING STORIES which would use a professor as a character. Also, a building was made to vanish around the professor and his wife. The latter found herself in mid-air, to her immense terror. This story appeared in AMAZING STORIES just one month later. A little variation could be seen, but they were practically the same. The professor's friend got the fright, not his wife.

If you receive a large number of letters on mental telepathy this month, it would not be a freak.

Hoping to hear from you, I remain

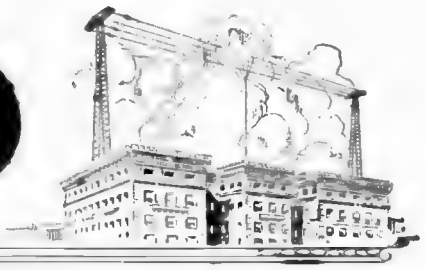
R. L. DIONNE,
Prince Albert, Sask. Canada.

(We do not think that the particular associations mentioned by you are the result of mental telepathy. You must be aware of the fact that several individuals could be working on the same invention at one and the same time. All of our inventions are led up to gradually. Rarely is there a drastic step either in one direction or the other. When Marconi first invented radio, it was not considered to be a remarkable system of communication. When a radio set first signalled its SOS message across the sea, radio as a means of safety was immediately pressed into service by most of the maritime countries. This actually put radio before the people in a very impressive manner. It was not, however, the first demonstration of radio.

Not until radio broadcasting became popular in its present form, was the radio telephone thought commercially practical. Mr. Gernsback believes that in the future, everyone will have a radio telephone and that these radio telephones will be small enough to carry around in the average touring car. Perhaps with an improved method of transmitting and with an improved system of reception, hundreds of thousands of sets could be operated at one and the same time without undue interference. It may be that future radio telephones will be so arranged that the company supplying them will automatically tune and set a transmitting and receiving instrument for party use. Thus, if we can dream of future possibilities, the same would be true of yourself. If you keep abreast with science, you can almost "feel" what the nature of the next development will be.

It is one thing to conceive of an idea and another to develop it.—EDITOR.

RADIO

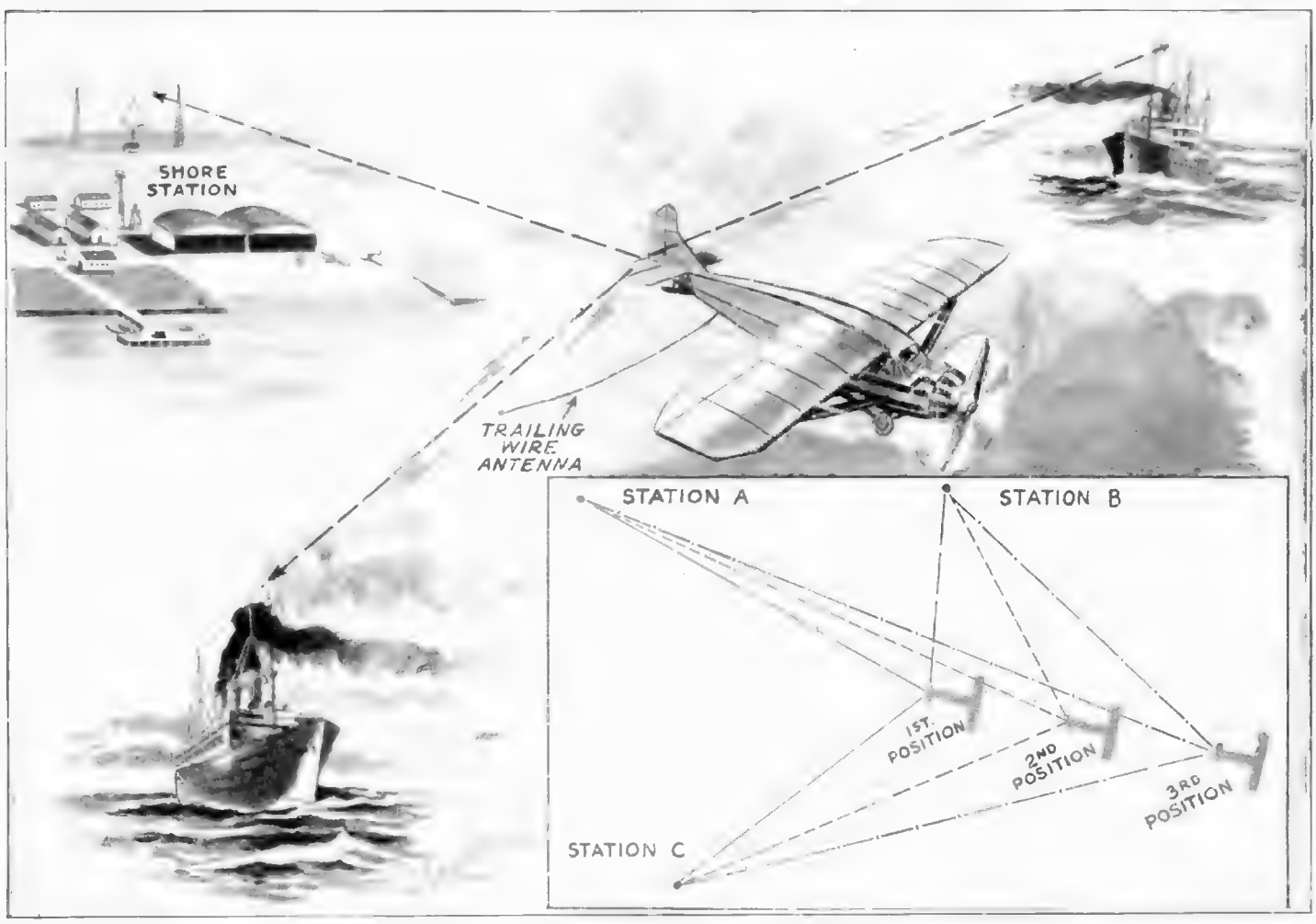


The Radio Plane Locator

Stations Equipped With Radio Compass Can Find Exact Position of Airplane

WITH the advent of long-distance, non-stop airplane flights, particularly across the ocean, it has become necessary to find some means of linking the planes with the world at all times. The fate of Nungesser and Coli has made it imperative that long distance traveling airplanes be equipped with radio. Radio experts have strongly advised the addition of a suitable radio transmitter, to the plane's equipment, that can be utilized for constant communication while the ship is in flight. The transmitter will derive its power from a wind driven electric generator. This transmitting apparatus will send out dashes or dots continually while the plane is in flight so that ship and shore stations and all radio compass or direction finding stations can easily determine the exact course taken by the aviators.

Long dashes or dots will be automatically transmitted, say at intervals of about one minute, on the 800 meter wavelength. This scheme will have the advantage of conveying to all listening stations that everything



An airplane, equipped with a trailing wire antenna, sends out signals automatically. These signals are intercepted by radio receiving stations, equipped with radio compasses, which are thus enabled to find the position of the plane at any given moment.

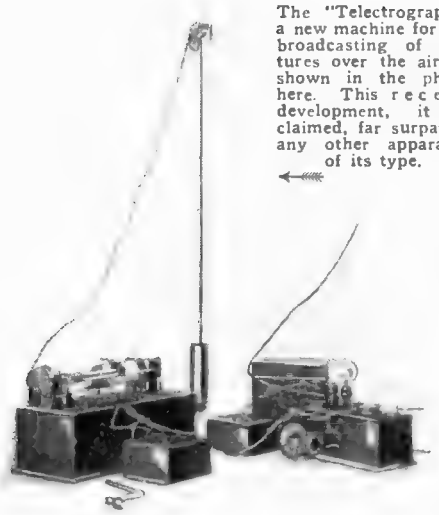
By referring to the above diagram it will be seen how stations A, B and C receiving the signal from the plane at the same time can determine its position. Note the peculiar construction of the receiving antennae on the ships and shore station.

is all right with the plane as long as the signals are heard. If the signals stop, however, ships in the vicinity which have been listening to the signals and making compass readings, can proceed with all speed to the point indicated by the last bearing taken. It will not be necessary for the aviators to touch the transmitting key. A control switch may be provided so that the transmitter can be changed from the position of automatic (clockwork) transmission, over to such a position that it may be utilized to transmit code messages. The transmitter will be dependent alone for electrical energy upon the wind driven generator. No matter what speed the plane is making, an automatic governing device will regulate the speed of the generator so that the desired electrical potential may be constantly maintained. The transmitter will be of the self-rectified continuous wave type, probably the most efficient system yet devised, as far as carrying power is concerned.

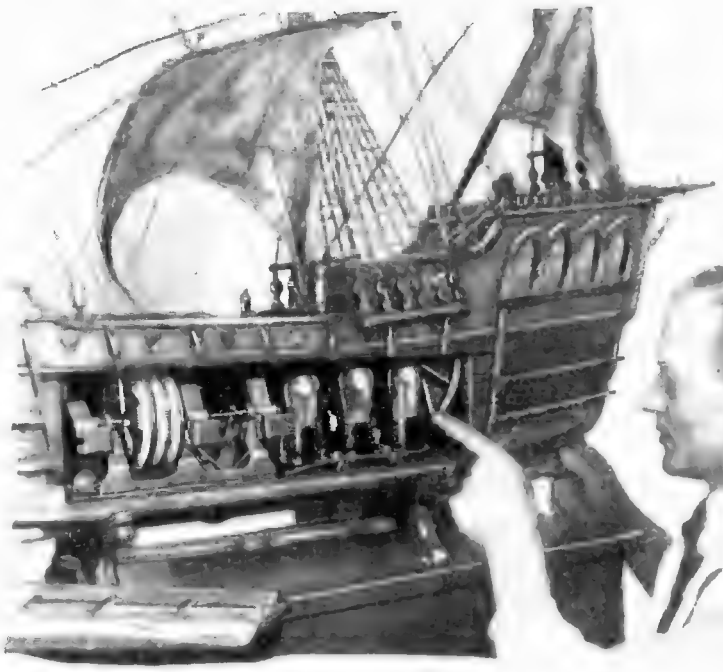
The receiving stations will utilize the well known Robinson or Bellini-Tosi systems of position finding. These stations will be equipped with radio goniometers or compasses and will thus be able to plot the exact position of the plane, by the interchange of compass readings between stations.

Latest Radio Developments

Progress in the Radio Field Shown in Pictures



The "Telectrograph," a new machine for the broadcasting of pictures over the air, is shown in the photo here. This recent development, it is claimed, far surpasses any other apparatus of its type.

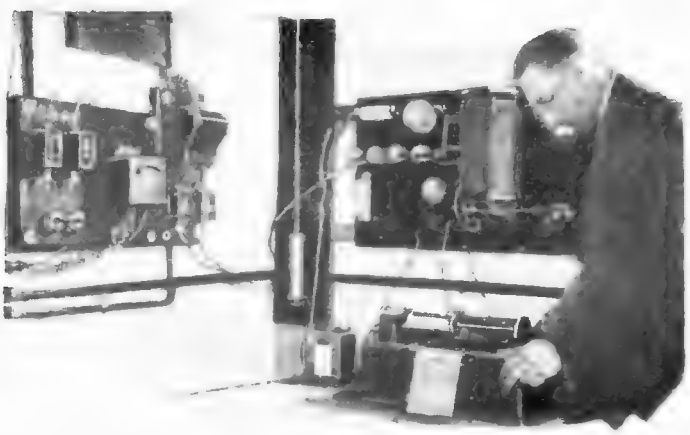


Perhaps the most original radio idea in some time is that of Karl Bauer who has built a model of the "Santa Maria" in which to house a complete five tube receiver.

Mr. Bauer is shown here with his novel radio set. The ship is made of violin wood which adds to the tonal quality of the receiver, and the sails are set in such a manner that they deflect and diffuse the output of a small cone speaker. The set uses drum control and the interior is illuminated at night. The builder has fittingly named his set the "Stradivari."

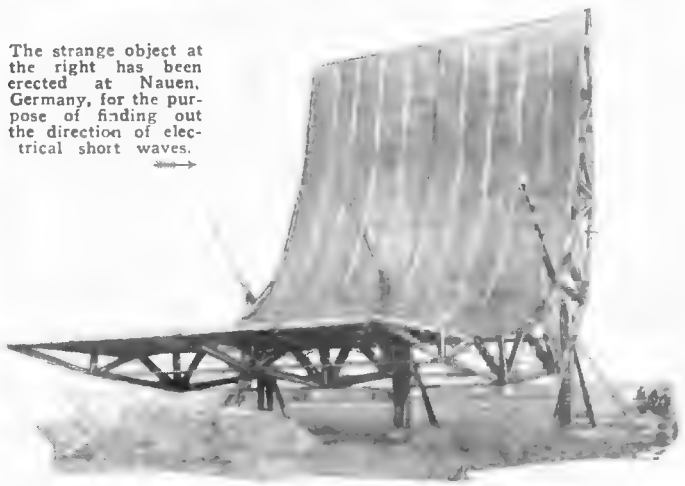
The L and N Railroad System has installed radio receivers in all their trains, which run daily between Louisville, Nashville and New Orleans.

Two passengers on the L and N Railroad are shown above enjoying a radio program while the train carries them to their destination.



Austria is to be the first country on the Continent in which the broadcasting of pictures is to be introduced. The apparatus to be used appears above.

The strange object at the right has been erected at Nauen, Germany, for the purpose of finding out the direction of electrical short waves.



The world's strangest signboard, a directional radio antenna, is shown above.

Treasure Chest Super-Het

In Which is Described the Construction of a Highly Selective One-spot Super-Het Receiver.

By WARREN G. POST and LEO A. BRAMS

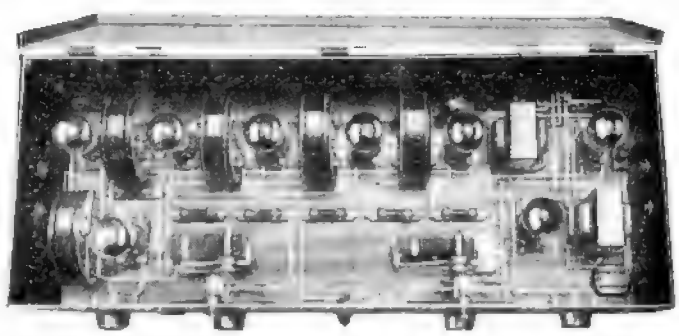
A view of the completed Treasure Chest, super-heterodyne receiver is shown in the photograph at the left. Note that artistic handles were attached to the sides of the cabinet, so that the set could be moved with ease. Observe also the placement of the control dials and filament switch.

THE one-spot super is indeed a treasure chest for, not only does it afford a pleasing appearance, but it constitutes a type of receiver that is gradually becoming more and more popular with the radio fan. Years ago the amateur experimenter and radio fan were unable to construct a super-heterodyne receiver that would perform efficiently because they were unable to purchase a set of intermediate radio-frequency transformers that were perfectly matched. Today manufacturing conditions have changed. By special processes used, manufacturers are now capable of putting forth a set of transformers that are matched as closely as they can possibly be. The success of any super-heterodyne depends almost entirely upon the type of radio-frequency transformers used.

CONSTRUCTING THE RECEIVER

There is, of course, no question that the super-heterodyne receiver is the most selective of all the types of sets on the market today. In considering the selectivity of a super-heterodyne we have many points to take into consideration. Much of the selectivity is due to the fact that the intermediate frequency transformers have a sharp peak, allowing only a narrow band of waves to pass. This article is not intended to be a complete solution of the selectivity problem; its sole object is to indicate a few lines of research and experimental work which can be done in this respect. The question of pick-up from an outside station is closely related to the pick-up of energy by one part of a receiver from another. It is for this reason that shielded coils were used. The schematic diagram shows the arrangement of the oscillator coil, the intermediate frequency transformers, and the filter transformer. The unit used in this set as an oscillator, when tuned with a .0005 microfarad variable condenser, will cover all wavelengths from 200 to 600 meters. The oscillator circuit has absolutely no harmonics. This eliminates all interference with the harmonics from other stations. It will also be noticed from the schematic diagram that the output of this oscillator is not mixed with the signal in the grid circuit of the first tube as is the customary practice. This means that it is practically impossible to tune in two stations at the same time. The transformers are shielded from each other, thereby eliminating any possible interference from outside pick-up or interstage coupling.

The disposition of the various components may be seen in the photo at the right. The neat interior appearance of the receiver should appeal to many radio fans. The two stages of audio-frequency amplification are placed on the right hand side of the baseboard. The loop terminals are situated on the left and the battery and speaker terminals on the right.



DETAILS OF ASSEMBLY

The lay-out of the instruments on the panel of the super, as may be seen in the photograph, is particularly pleasing in appearance and at the same time well-planned, in order to make the wiring easier. Take some sheets of fine emery cloth and rub it over the metal panel in one direction only. Next drill the necessary holes for mounting the two variable condensers, two rheostats, and the filament switch. Having done this mount the parts on the panel. Take the subbase and sandpaper the top surface. Shellac the board and allow it to dry. When dry, proceed to mount the parts on it. Arrange the parts so that when wiring the receiver the leads will be as short and direct as possible. The accompanying photos show the baseboard lay-out clearly.

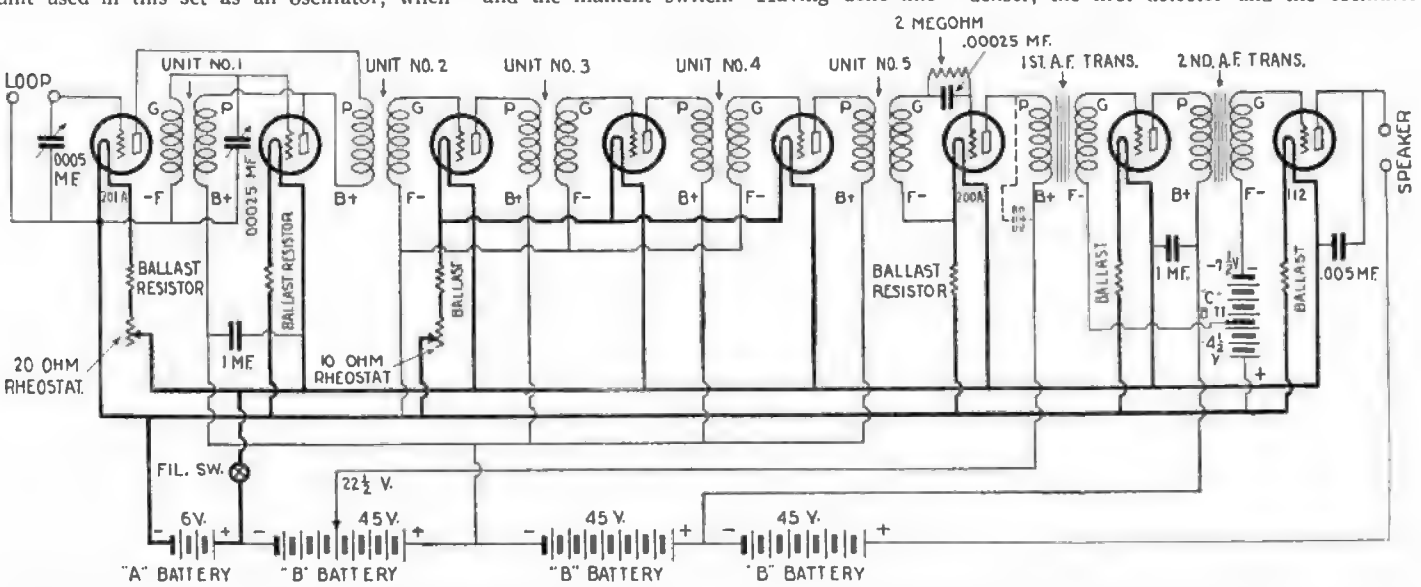
LIST OF PARTS

The following is the list of parts used in constructing the silver chest receiver:

1—.0005mfd variable condenser
1—.00025mfd variable condenser
2—illuminated dials
8—type U.X. sockets
2—super audio transformers
1—10 ohm rheostat
1—20 ohm rheostat
1—pilot light switch
1—.00025mfd fixed grid condenser
1—.005mfd fixed condenser
1—2-meg. grid leak
1—Yaxley or Jones cable connector, complete
7—engraved binding posts
1—Set of 5 type HW Madison Moore Precision Units
2—1mfd. by-pass condensers
1—Pair of grid leak clips
6—Filament resistances.
1—10″ x 26″ x ¾″ wooden baseboard.

HINTS ON WIRING

To begin with, it is easier to wire the complete filament circuit, as this is common throughout the receiver. Next wire the tuning circuits, consisting of the tuning condenser, the first detector and the oscillator



The schematic diagram of the one-spot super is shown above. Ballast resistors are used to control the filament current.

A type 112 tube is used in the last audio stage, a 201-A for the first detector and a 200-A for the second detector.

circuit. Having completed this, the intermediate radio-frequency stages are wired, and finally the second detector and audio-frequency stages. The circuit as shown in the diagram provides for the use of a loop only, but an antenna can be used with the receiver by connecting an antenna coupler to the loop terminals.

CONSTRUCTION OF THE SILVER CHEST

Having secured the brass and copper cut to the size given in the specifications below, take the front and side piece and bend at a 90 degree angle 10″ from both ends. Now take the top piece and make a short bend of ½″ in from both of the 27″ ends. This bend should also be made at 90 degrees. Cut the cover to allow for a ½″ bend on the long ends. You now have all the sides including the top of the cabinet bent and cut ready to assemble. Before finishing the cabinet, solder the corners carefully where the cover is bent. In this particular case the cabinet was finished by rubbing a piece of emery cloth along the surface in one direction only. This makes a perfect grain. The copper strips should next be placed in position. The strips are held in place by copper rivets which are spaced approximately 1½″ apart. The two hinges are attached to one side of the cabinet. The corroded copper finish affords a pleasing appearance. A cloth dipped into a solution of nitric acid and copper shavings will, when rubbed upon the copper, produce this unique effect. The cabinet may then be nickeled.

CABINET SPECIFICATIONS

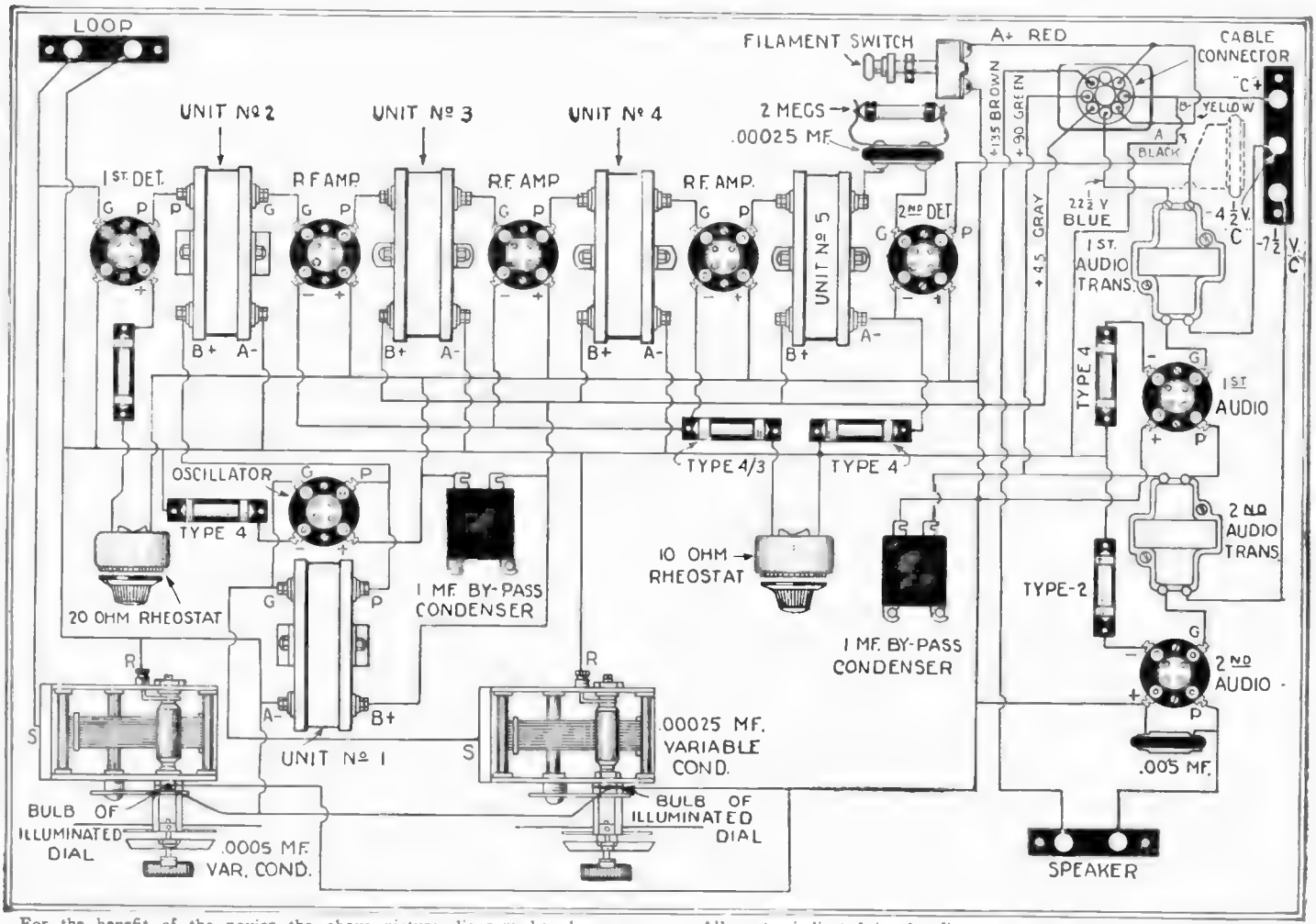
The following are the necessary sizes and specifications of the parts needed in the construction of the chest, for this receiver.

1 piece of brass 7″ x 46″ for front and sides
1 piece of brass 7″ x 26″ for back
1 piece of brass 10½″ x 27″ for cover
4 strips of copper 8″ x 1″
2 strips of copper 10⅞″ x 1″
All stock should be ⅛″ thick

TUNING THE RECEIVER

This receiver is not as easy to operate as one which merely necessitates turning the dials to tune in a station. Due to its extreme selectivity and sensitivity together with its wonderful tone quality, it will prove to be the latest thing in radio reception when its operating characteristics are thoroughly understood and patient tuning is observed. In its operation, however, some instruction and practice are necessary. For local reception, lower filament temperature is used on the intermediate radio-frequency stages than for distant stations. Properly constructed this receiver will tune in a station at only one place on each dial. This is only possible with the proper operation of the first tube. If the rheostat controlling the first tube is kept at a position which keeps the first tube just under the point of oscillation, the loop tuning dial will be extremely sharp and stations will not be heard unless both circuits, the loop and oscillator circuits, are kept in absolute resonance. It is absolutely essential that both circuits be in resonance, as otherwise even local stations will not be heard. If the first tube is permitted to oscillate, stations ill be received at more than one part on the dial. List of parts manufacturers on request.

Another view of the completed receiver is shown here. Before testing the receiver check all wiring to make sure that no mistakes have been made. Insert the tubes in the sockets and connect the A battery to the B battery terminals. If the tubes light when the A battery is connected in this manner it indicates that a short circuit exists between the A and B batteries.



For the benefit of the novice the above picture diagram has been published. A cable connector is used for all battery leads going to the set. Note that the bulbs of the illuminated dials are connected in parallel with the A battery.

All parts, indicated in the diagram given here, correspond with the baseboard lay-out. A 20 ohm and a 10 ohm rheostat are used in conjunction with the ballasts so that fine filament control may be obtained.

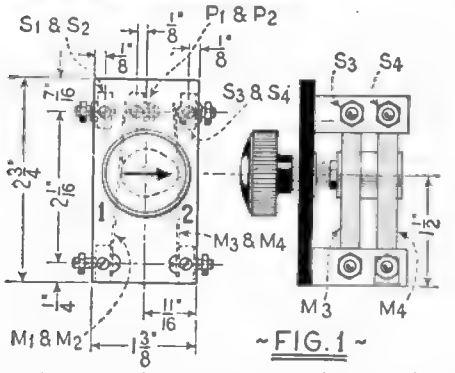
TOOL LIST

Pliers, several kinds
Screw drivers, several sizes
Hammer, hacksaw and blades
Hand drill
Twist drills, several sizes
Scriber
Center-punch
Soldering iron, electric or other type
Wire solder, self-fluxing or plain solder and non-corrosive flux
Rule, steel or wood

Making an Amplifier Switch

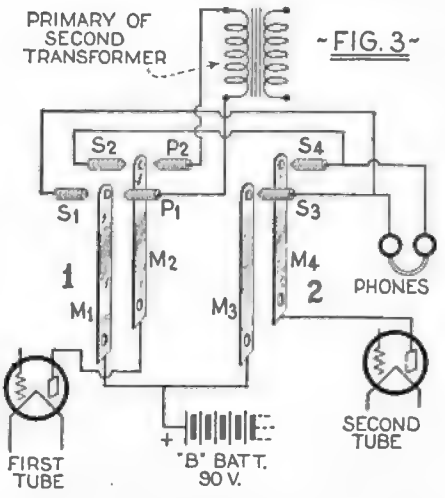
By H. R. LUBCKE

At the left is a photograph of the completed amplifier switch, which eliminates the jack and plug system usually employed.



~FIG. 1~

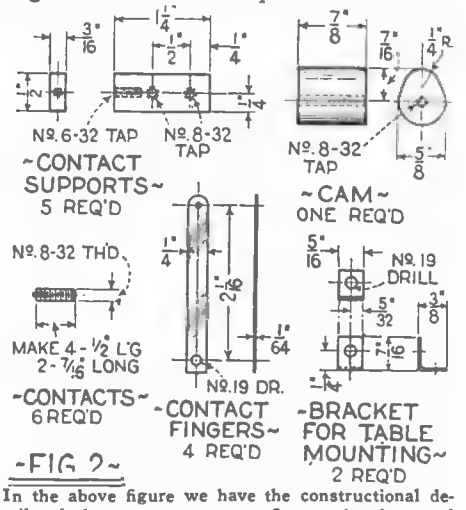
The front and side views of the switch are given above. The switch consists essentially of four fingers which make or break contact with the stationary members.



~FIG. 3~

In Fig. 3 the hook-up of the amplifier switch is given. Note the connections which go to the fingers and to the various contacts. The primary of the second transformer is connected directly to the contacts P_1 and P_2.

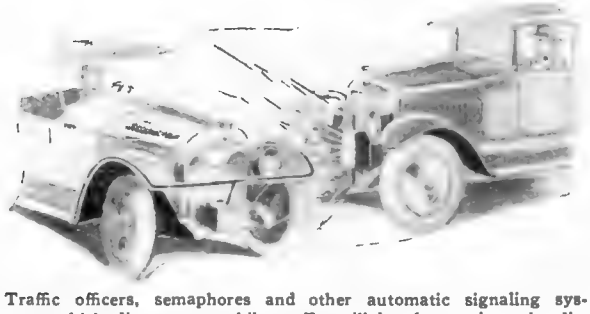
EASE of control and improved appearance may be obtained by using the amplifier switch as described here. The details of construction and assembly are shown in the various sketches. With the pointer at "1" the raised part of the cam presses fingers M_1 and M_2 against contacts S_1 and S_2. With the aid of Fig. 3, which shows the hook-up, it will be seen that the output of the first stage is connected to the phones when the switch is in this position and when the pointer is at "2" the output of the second stage connects with the phones.



~FIG. 2~

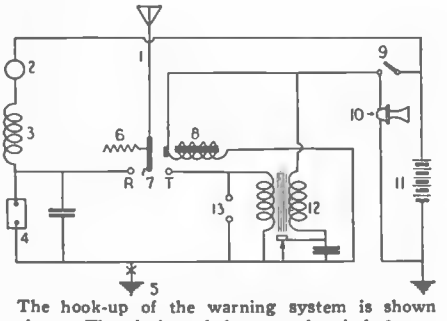
In the above figure we have the constructional details of the contacts, contact fingers, brackets and cam.

Radio Directs Auto Traffic



Traffic officers, semaphores and other automatic signaling systems which direct automobile traffic will be thrown into the discard if a new French invention comes into use. Above we see two autos equipped with the radio warning system.

THE motorists of the future instead of operating the horns on their automobiles as done now will commission radio to perform this function automatically. A recent patent issued to Harry Flurscheim, of Paris, France, provides for a radio warning system to be used on vehicles. The body of the car prevents the reception of waves from the rear and also prevents radiation of waves to the rear. The apparatus for the emission and reception of the signals is mounted in a suitable box placed on the front of the radiator of the usual type of vehicle.

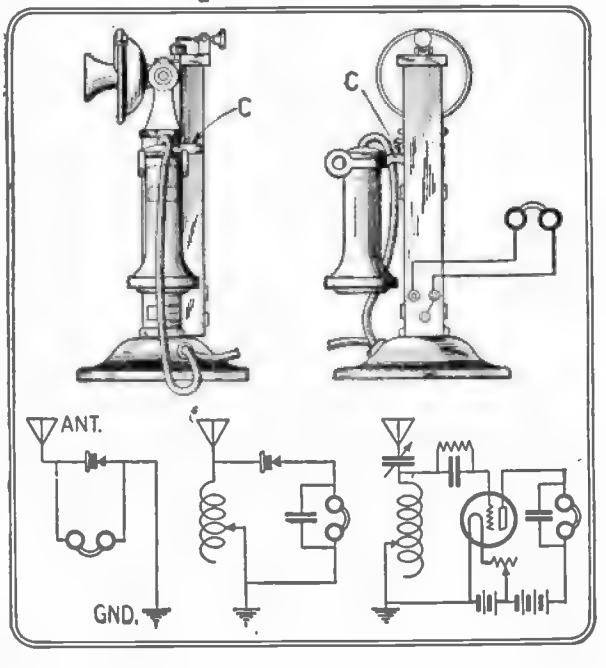


The hook-up of the warning system is shown above. The closing of the control switch 9 connects the battery with an electro-magnet operating a switch.

Combination Radio Set and Telephone

George F. Mitchell, inventor of the new receiving attachment is shown above listening in with his novel device.

Lift your telephone receiver and hear radio programs! Impossible, — not at all if you employ the device shown here. The small instrument which weighs but 3½ ounces, does not require the use of a head set, loud speaker, or antenna for the reception of radio programs and may be easily slipped into the vest pocket. When attached to the telephone systems where one side of the line is grounded the radio set can be connected to the grounded side and thus an independent ground becomes unnecessary. A clamp is provided which holds down the receiver hook while the radio set is being used. A simple crystal receiver or a vacuum tube may be employed.



RADIO ORACLE

In this department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this department cannot be answered free. A charge of 50c. is made for all questions where a personal answer is desired.

POWER TUBE ON A.C.

(558) H. L. Bernstein, Akron, Ohio, writes:

Q. 1. I have an eight-tube super-heterodyne receiver, using a CX-220 in the last audio stage, with a 22½-volt C battery. I want to assemble a B eliminator using the Thordarson R-171 power compact with the Raytheon BH tube to replace my B batteries. Can I not run a separate circuit from the 6-volt terminals of the eliminator to the filament terminals of the last audio stage socket and operate a CX-371 power tube in this socket?

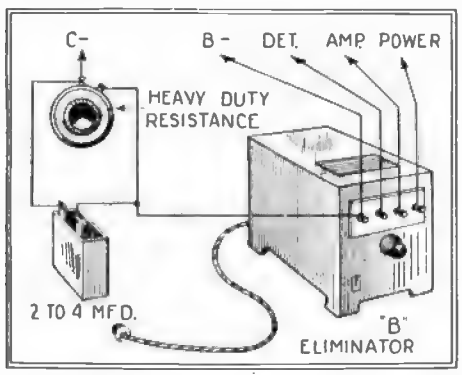
A. 1. Yes, you may do as you suggest.

Q. 2. Would it be advisable to use an amperite in this circuit?

A. 2. No, the voltage delivered by the transformer for this purpose is five, therefore no amperite is needed.

Q. 3. With the CX-371 tube in the last stage can I use the CX-220 in the first audio stage?

A. 3. No, the CX-220 is an output tube. We would recommend using in its place a CX-299.



The above illustration shows the changes which have to be made in the "B" eliminator in order to obtain "C" voltage. The heavy duty resistance should be rated at about 2,000 ohms.

C VOLTAGE FROM B ELIMINATOR

(559) L. Montague, El Paso, Texas, asks:

Q. 1. How can I obtain C battery voltage for my power tube from my present B battery eliminator?

A. 1. You will find illustrated on this page the necessary changes you will have to make in order to obtain the C battery voltage. The heavy duty resistance shown in the diagram should be capable of carrying at least 50 milliamperes without serious overheating and should have a total resistance of about 2,000 ohms. The fixed condenser should have a capacity of at least 2 microfarads; lower values of capacity may cause some hum. With this circuit the C voltage is, in effect, subtracted from the B voltage available on the power binding post of the eliminator. Consequently the arrangement is practical only with the more powerful types of B eliminators. After you have hooked up the apparatus as shown, set the knob so that the resistance is all in use, turn on the radio set and the B eliminator, and then slowly turn the knob until volume and tone quality are best. Do not turn the knob any farther than necessary to get proper volume and quality, because if you cut the resistance down too far the C voltage will be too low and the life of the power tube shortened materially.

TROLLEY CAR INTERFERENCE

(560) The Ipswich Wireless Company, Ipswich, England, writes:

Q. 1. We would be grateful if you could inform us of any single instance where overhead trolley interferences have been minimized to such an extent that they warranted the expense entailed by using condensers, etc.

A. 1. Overhead trolley interference is a difficult matter to eliminate satisfactorily, as it calls for choke-condenser interference filters on each separate motor of each trolley car, both the driving motors and air compressor motors, if there are any. These arrangements have to be capable of carrying a good deal of current if chokes are used which means large wire, but sometimes condensers alone are sufficient. If the trolley company is sincerely willing to go to some expense, fixed condensers of proper voltage rating should be placed in series across the leads to the motors, two being used on each motor with the mid-tap grounded. This will probably assist considerably, although it would be better still to put air-core chokes on each side of the line leading to the motor as well, consisting of 150 to 250 turns of wire of the proper size to carry the current, wound on an insulated tube. The most difficult thing to take care of is the sparking at the trolley wheel. By fitting three trolley wheels on the end of a trolley pole, following each other, this sparking can be considerably reduced and a further improvement might be effected by grounding the trolley wire, through fixed condensers at each pole, in the neighborhood of worst interference.

KICK-BACK PREVENTERS

(561) L. Quentin, Baltimore, Maryland, asks:

Q. 1. What are the simplest and most efficient pieces of apparatus used as kick-back preventers and what purpose do they serve in a radio transmitting set?

A. 1. If no precautions are taken, trouble will often be encountered at transmitting stations due to radio frequency current finding its way either directly or inductively back to the source of power supply, or to other adjacent circuits. Serious difficulties may arise from this cause. Transformers and generators may be burned out, or persons may be injured by the shock. Choke coils of suitable inductance may be inserted in the leads from the power supply to the transmitting apparatus which will prevent the flow of radio-frequency current, but permit the flow of audio-frequency current. By-pass condensers of suitable capacity may be connected across the leads from the power supply to the transmitting apparatus. These condensers will offer a path of low impedance to radio-frequency current. Instead of condensers aluminum electrolytic cells may be connected across the line.

FADING OF SIGNALS

(562) C. A. Orr, Jordan, New York, writes:

Q. 1. I have a five-tube receiver in which I use a CX-300-A detector tube. The reception is good, but frequently I am troubled with the gradual fading of signals and often complete stoppage of reception. At such times the signals may be restored by switching a light or the trickle charger on and off. I experience this trouble all day up until eight o'clock at night. I have changed the set to a new location, likewise the antenna and ground, but with no effect. Can you suggest the cause and a possible remedy?

A. 1. Make sure that your trickle charger is charging the A battery. Charging is often taken for granted because the charger is connected to the battery. Test your B battery for voltage. A 45-volt unit should not be used after it drops below 34 volts, if the best results are to be expected. Change the tubes around in the sockets. Partial or complete stoppage of signals may result when a powerful nearby receiver is tuned to the same wave you are receiving. The ordinary remedy for this condition is the relocation of your antenna, receiver and ground connection. Place your antenna at right angles to the other antenna, or vertically. Also check over your receiver for bad connections.

SERIES VS PARALLEL CONNECTION OF FILAMENTS

(563) H. Maxine, Juneau, Alaska, asks:

Q. 1. Is there any advantage in connecting the filaments of the tubes on my receiving set in series rather than in parallel?

A. 1. A strange illusion persists that the mere connecting of vacuum tube filaments in series instead of the usual connection in parallel has some effect upon the working of the tubes. There is no truth in it. The sole idea of the filament in a tube is to provide a hot metal body which will emit electrons. It makes no difference whatever in the tube action whether the metal is heated by passing a current through it, building a fire under it or hitting it with a hammer, so long as the same temperature is reached. The difference that is made by the series connection of filaments instead of parallel connection is not a difference in tube action but a difference in the requirements of the circuit hook-up. The grid return of each tube determines the grid bias of that tube. With series connection of filaments, if all the grid returns are made to one point, say the minus lead of the supply, no two tubes will have the same grid bias. There is a drop in voltage in each filament and each tube will have a gradually decreasing negative bias. If each grid return is to its own negative filament each grid will have no bias relative to its own filament, but there will be an existing potential between any two grids. This of itself does no harm. The reason for parallel connection lies in the standard fixed voltage of the storage battery and the varying numbers of tubes in different sets, all of which are made for the same battery voltage.

METALLIZED RESISTORS

(564) V. D. Renwick, Merchantville, N. J., writes:

Q. 1. Will you please give me some information regarding the method of "metallizing" glass, such as is used in resistors for radio purposes and advantages gained with this type of metallized resistor.

A. 1. The present type of metallized resistor, with glass core which fulfills the most exacting requirements that could be placed on a high resistance unit, has finally been produced after much experimentation. The glass tube, internally coated with a thin film, was abandoned. In its place a fine glass filament is used. This filament is spun by a most ingenious machine into lengths of 500 feet, which are entirely uniform from end to end. The glass thread or filament is next passed through a solution of a salt, which will give a conducting coating when reduced by heat and a reducing agent, and then through a high temperature furnace through which a steady flow of gas is maintained. This process results in the production of a perfectly homogeneous conducting surface, thoroughly hardened upon one of the best insulators known. The externally coated filament, no larger than the usual lead-pencil core, has many advantages over the internally coated tube. First, due to the small area of the filament, it is possible to give it quite a thick coating of conducting material and at the same time to have a very high resistance. Secondly, it is comparatively easy to put a protective layer over the conducting filament. Thirdly, it is relatively simple to measure the conductivity of the coated filament as it is fed out of the coating machine. The case of measurement obtained in the case of the coated filament insures a uniform product. After the filament has left the furnace, it is coated with a durable protective film of insulating varnish which is then thoroughly dried by the application of heat. This impenetrable coating completely protects the conducting filament against atmospheric changes.

INDUCTION FROM TELEPHONE LINES

565) Anton Schleck, Bridgeport, Conn., writes:

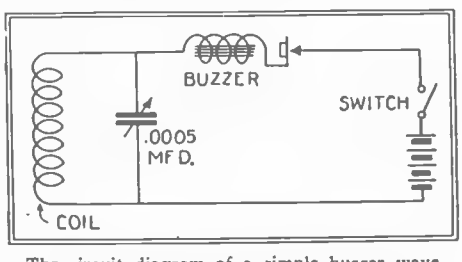
Q. 1. For the past year the writer has been listening to various telephone conversations, by means of a radio receiving set; conversations between people in this city on the ordinary telephone line. The other night, while listening to a radio station, a loud dialogue broke in on the concert and assumed such a volume that the radio program was almost drowned out. The antenna and ground are not very near the telephones and I cannot understand how this can happen. I would be glad if you could give me an explanation of this phenomenon.

A. 1. This is a plain case of induction. The telephone wires produce an electromagnetic field around them, which varies in intensity just as the voice currents travelling over the wires vary. Your antenna is probably within the range of these fields and a feeble current is either induced in it or directly into the input of the audio-frequency amplifier. Such an occurrence happens quite often and we receive many of these letters on this particular subject. The cause is ordinary electromagnetic induction, the same thing that causes the transfer of energy between the primary and secondary coils in your receiver.

SIMPLE WAVEMETER

(566) K. O. Hearst, Havana, Cuba, writes:

Q. 1. I understand that a simple and efficient wave meter can be constructed using only a tuning coil, variable condenser, buzzer, switch and battery. If this is so, will you please tell me how to connect up these components?



The circuit diagram of a simple buzzer wave meter is shown above. The variable condenser should have a capacity of .0005 mfd. and should be of the same type as used in the receiving set.

A. 1. A diagram of the connections for a simple buzzer wavemeter using the parts you mention is shown on this page. The buzzer, switch and battery are connected in series with the tuning coil and the variable condenser is connected in parallel with the coil. The condenser should have a capacity of .0005 microfarad and should be of the same type as is used in the receiving set. The size of the tuning coil will depend on the wave length range which the meter is to cover and about 50 turns of No. 22 magnet wire wound on a form having a diameter of 3½ inches will be suitable for wave lengths from 175 to 550 meters.

DIFFERENCE BETWEEN CX-301-A AND C-301-A TUBES

(567) J. Brecht, Sydney, Australia, asks:

Q. 1. Can you tell me the difference, if any, between the CX-301-A and C-301-A tubes?

A. 1. The CX-301-A is electrically the same as the C-301-A but is mounted on a CX standard base instead of on the old type navy base. When the new base was adopted no change whatever was made in the characteristics of the tube. Compared with the C-301-A of 1923, however, the CX-301-A has a higher efficiency, resulting in improved performance. This increase in efficiency was gained through a 20% increase in mutual conductance.

Scientific Humor

DID HE SWALLOW A SET?

KID: "What is that?"
DOCTOR: "This is a stethoscope."
KID: "Are you getting any distant stations?"—*Leslie Carpenter, Rep. No. 8520.*

LOOK 'EAR

PHYSIOLOGY PROF: "What is the name of the canal between the inner ear and the throat?"
DUMBBELL: "The *cary* canal."—*Author please send address.*

BREATH TAKING

DOCTOR: "Deep breathing, you understand, destroys microbes."
PATIENT: "But how can I force them to breathe deeply?"—*Clifton Ask.*

QUITE RIGHT

"Where do all the old cars go?"
"They don't!"
—*Clifton Ask.*

FATAL

BRIGGS: "Who killed that escaped convict?"
GRIGGS: The paper says the coroner's jury sat on his body."—*John H. Spicer.*

LIKE ALL OUR BRUSHES

PAINTER: "Why don't you paint?"
ASSISTANT: "There is dandruff in this brush."
PAINTER: "What makes you think so?"
ASSISTANT: "The hair keeps falling out."
—*Leslie Carpenter.*

A WASHOUT

LAUNDRYMAN: "—and we guarantee there'll be no fading."
BUG: "Here, wash my radio set!"—*George W. Knapp.*

A FAKE

WILLIE: "Maw, that dentist you sent me to, that was advertised as painless, wasn't."
MOTHER: "He wasn't?"
WILLIE: "Naw! I bit his finger and he yelled like any other dentist."—*Walter R. Miller.*

AN ARM-Y RIDDLE

"Why can't a Willy's Knight roll up its sleeves?"
"Because the wrist pins hold 'em down."
—*Walter R. Miller.*

First Prize $3.00

OLD AND NEW METHODS

IVAN: "Is the washer that salesman sold you from America any good?"
MRS. IVANITCH: "No, everything is all right until I get in it and then the paddles knock me off my feet.—*Leslie Carpenter.*

EXACTLY

GUIDE: "These magnificent mountains are two million years and four months old."
TRAVELER: "How do you know their exact age?"
GUIDE: "A geologist studied them four months ago and he told me they were two million years old then."—*W. C. Michel.*

WE receive daily from one to two hundred contributions to this department. Of these only one or two are available. We desire to publish only scientific humor and all contributions should be original if possible. Do not copy jokes from old books or other publications as they have little or no chance here. By scientific humor we mean only such jokes as contain something of a scientific nature. Note our prize winners. Write each joke on a separate sheet and sign your name and address to it. Write only on one side of sheet. We cannot return unaccepted jokes. Please do not enclose return postage.

All jokes published here are paid for at the rate of one dollar each, besides the first prize of three dollars for the best joke submitted each month. In the event that two people send in the same joke so as to tie for the prize, then the sum of three dollars in cash will be paid to each one.

NEED-LES TO SAY

FIRST NURSE: "Don't you find the doctor very funny?"
SECOND NURSE: "How is that?"
FIRST NURSE: "Because he's got most of his patients in stiches."
—*James A. Carroll.*

A LESSON LEARNED

STUDENT who was absent the day before: FIRST: "Alice, what did you do in chemistry yesterday?"
SECOND: "We did experiments with sulphuric acid."
FIRST: "What were the results?"
SECOND: "Two holes in my dress and a headache."—*Ellen Kertz.*

BA-CILLI

A MICRO-ORGANISM: "We can pardon the German for calling it a 'germ'; we can excuse the Frenchman for calling it a "parasite"; and we can tolerate the Irishman when he calls it a 'microbe'."—*A. G. Drew.*

HOLEY EFFICIENT

"How are you getting along since your wife left?"
"I've reached the highest point of efficiency. I can put my socks on from either end." — *M. M. Raub.*

LEARNING THE CHICKEN LANGUAGE

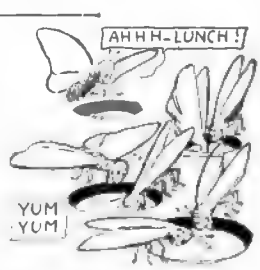
SCIENCE READER: "I noticed the other day where a poultry raiser was making a study of the chicken language."
MR. KNOW-IT-ALL: "I made a study like that once myself so as to be able to tell when a hen cackled whether she had laid or lied."
—*Alfred T. Bullock.*

P-RAYS-ED

ELECTRICAL STUDEN : "I can't help admiring her ultra-violet beauty."
LITERARY STUDENT: "That's a sweet poetic expression, but what do you mean?"
ELECTRICAL STUDENT: "I can't see any."—*Norvell C. Wood.*

SO WE'VE NOTED

"Moths are very economical."
"How's that?"
"They eat nothing but holes."—*Clifton Ask.*



SCIENCE VS. LAW

PHYSICS TEACHER (having a review): "Are there any questions that you would like to have discussed?"
CLARE (a student who expects to study law and finds physics a bore): "I would like to know how Boyle's Law is enforced?"
THE TEACHER hesitates, not knowing what to say and to his relief for once, the wit of the class responds: "Apply a little pressure."—*J. Grier Alexander.*

SCIENTY SIMON, SCIENTIST

THERE! NOW THE NEW FUSE IS IN---
GOSH!
WONDER WHAT THIS LOOSE WIRE IS?--
BAM
YES SIR! THIS IS GOING RIGHT BACK WHERE IT CAME FROM!
SAY MISTER! DIDN'T YOU TELL ME THAT THIS FUSE IS FULLY GUARANTEED? WELL! D'YA WANT TO KNOW HOW LONG IT LASTED?---
SCIENCE LESSON NO. 9
A "SHORT CIRCUIT" WILL CAUSE TOO MUCH CURRENT TO FLOW IN THE WIRES AND MAY RESULT IN A FIRE. A FUSE IS A SIMPLE DEVICE WHICH "BLOWS OUT" AND THUS BREAKS THE CIRCUIT WHEN THE CURRENT BECOMES TOO STRONG-
JUST THREE MINUTES!
W. LEMKIN

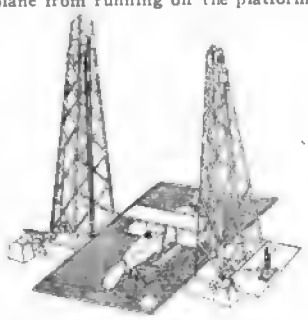
LATEST PATENTS

AIRCRAFT

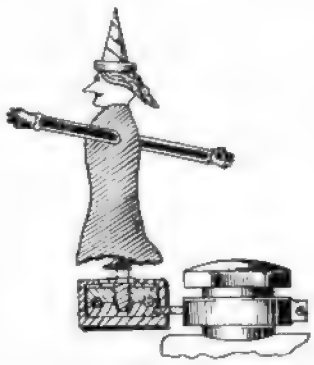
No. 1,619,100, issued to Mittie Taylor Brush. This particular invention provides for a means of lighting up the space adjacent to the plane and also enables the pilot to see the ground at a considerable distance above it. Incandescent electric lamps are placed upon the under surface of the wings and the fuselage. These lights are under control of the pilot.

AIRPLANE LAUNCHING AND LANDING APPARATUS

No. 1,625,020, issued to Federico Guillermo Diago. The apparatus shown below comprises a landing platform, a pair of towers and non-circular frames carried by the platform. Guides are attached to the platform to prevent it from tilting when raised or lowered. A guard is also provided to prevent the airplane from running off the platform.



AIR-OPERATED DEVICE

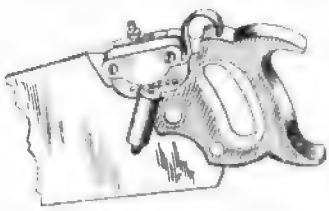


No. 1,624,018, issued to Harry Slater. This air operated device consists of a manikin having a pair of reversely positioned, hollowed-cut air operated hands for rotating the body and for swinging the hands vertically about the manikin. The device may be used as an auto radiator cap adornment.

PROCESS FOR BAKING PIES

No. 1,626,316, issued to Frank Merwin Wakeman. The invention provides for the forming of a juice retaining dam around the edge of a pie, which consists of a piece of gummed sealing tape. A section of the tape is moistened and placed around the edge of the pie plate. Upon heating, the paper draws snugly around the edge of the pie.

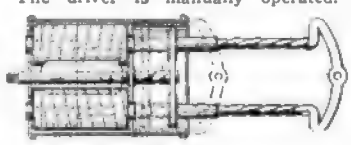
BLOWER FOR SAWS



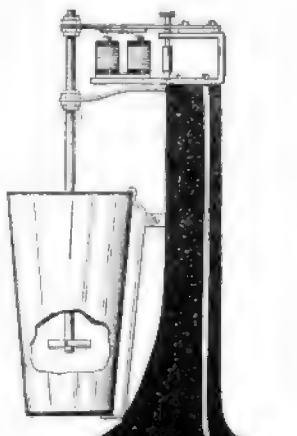
No. 1,623,859, issued to Charles Jerome Abbey. The blower pictured above can be used with cutting tools. The device when attached to a saw or the like, will blow the sawdust from the line or marks to be worked. The blower is attached to an air cylinder by means of a flexible hose. The air is ejected through a nozzle.

BLADE-STROPPING DEVICE

No. 1,624,592, issued to George D. Gallagher. The stropper shown below provides a device embodying new and improved features of convenience of operation. The stropping rolls and blade holder have an endwise shifting movement during the blade's oscillating movements. The driver is manually operated.



VIBRATOR

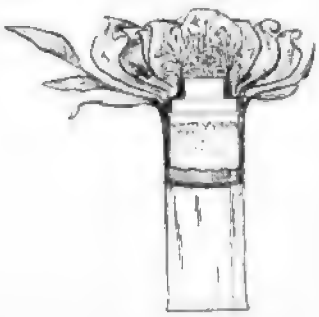


No. 1,623,987, issued to Leo J. Wahl. The vibrator or agitator shown here provides for the mixing of the contents of a receptacle. The device is operated by an electromagnet with a vertical vibratory armature. A pair of parallel springs are provided for supporting the armature.

POTATO SLICER

No. 1,619,746, issued to Frederick H. Miller. This potato slicer is designed for slicing potatoes for cooking in various ways. The cutter utilizes discarded safety razor blades because of their fineness and durability. The blades may be adjusted so as to prepare varied sizes of potato slices.

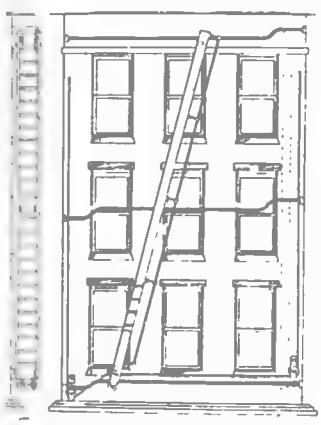
TOILET POWDER SHAKER



No. 1,625,092, issued to Ethel A. Poillon. The powder shaker is disguised by ornamentation and thus loses its utilitarian purpose. Not only is the powder shaker concealed but the powder is allowed to sift through a perforated top piece without the slightest hindrance. The top of the box is preferably concealed with an artifical rose and the sides of the container are painted in imitation of a rose holder.

FIRE ESCAPE

No. 1,623,821, issued to William P. Westfield. This particular fire escape combines upper, intermediate and lower horizontal rails. These rails support the ladder which has rollers and thus can be moved to any desired position. This structure provides a convenient descent for women and children.

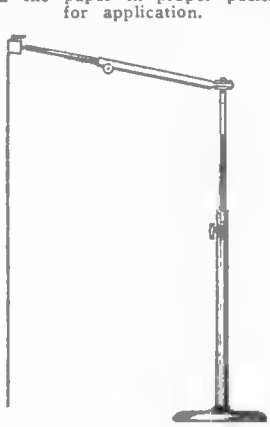


SWIMMING SHOE

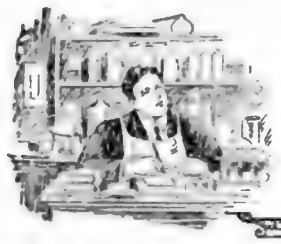
No. 1,626,175, issued to Joseph Zimmer. The swimming shoe comprises a sole shaped similar to the foot, a cage at the rear end of the sole, a strap at the forward end and a pair of fins larger than the sole, pivotally mounted. The straps limit the movement of the fins.

PAPER-HANGING DEVICE FOR WALLS

No. 1,626,020, issued to Ernest R. Burkey. This paper-hanging device has a standard formed in telescoping sections, which may be adjusted to different heights. A cross bar is mounted on the frame. The wallpaper is supported upon this bar and in this way it can be moved in close proximity to the wall and hung in place. The device can be quickly manipulated and adjusted to hold the paper in proper position for application.



NOTICE TO READERS. The above illustrated and described devices have recently been issued patent protection but are not as yet to our knowledge available on the market. We regret to advise that it is impossible to supply the names and addresses of inventors of the above devices to any of our readers. The only records available, and they are at the Patent Office at Washington, D. C., give only the addresses of the inventors at the time of application for a patent. Many months have elapsed since that time, and those records are necessarily inaccurate. Therefore, kindly do not request such information as it is practically impossible to obtain up-to-date addresses. —EDITOR.



THE ORACLE

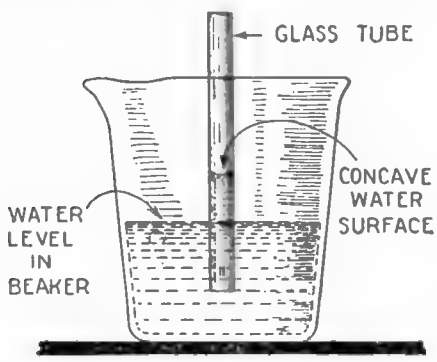
The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink; no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 50 cents is made for each question. If the questions entail considerable research work or intricate calculation, a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

CAPILLARY ACTION

(2184) E. S. Adams, Three Rivers, P. Q., Canada, writes:

Q. 1. When a glass tube is inserted into a beaker of water, the water rises in the tube. Can you give me the cause of this phenomenon?



The phenomenon of capillary action is clearly shown in the simple diagram appearing above. The water level in the beaker is not shown concave for the sake of clearness.

A. 1. The fact that water rises in a glass tube is due to capillary action. The adhesion between the water and the glass is greater than the cohesion of the water. This means that the attraction between the water and the glass molecules is greater than between the water molecules. Where the water touches the glass the excess of attraction between the water and the glass results in a pulling up of the water on the surface of the glass. The glass molecules cannot be pulled toward the water, so that the more easily moving water molecules are drawn upward by the glass. Inside the glass tubes the water rises to form a concave surface. The surface tension or film then tends to straighten the surface of the water. This causes the water level at the center of the tube to be raised above the level outside of the tube, then at the inner surface of the tube the water is again pulled up to a concave curve at the glass, and the surface tension again straightens it. This alternate climbing at the edges and the subsequent straightening of the liquid surface in the tube continues until the weight of the column of the water lifted equals the surface tension.

REPAIRING MEERSCHAUM PIPES

(2185) A. L. Butcher, Maryville, Tenn., writes:

Q. 1. I have several meerschaum pipes which have become broken, can you give me a method for repairing these?

A. 1. One of the most efficient and simplest methods of repairing these pipes is as follows: Clean a clove or two of garlic, by removing all the outside skin; throw into a small mortar and mash it to a paste. Rub this paste over each surface to be united and join quickly. Have ready some boiling, fresh milk; place the pipe in it and continue to boil for thirty minutes. Remove and let cool slowly. If properly done, this makes a joint that will stand any ordinary treatment, and which is nearly invisible. A cement for filling holes, if the parts do not fit properly, may be made as follows: Mix very fine meerschaum shavings with albumen or dissolved casein in water glass; stir finely powdered magnesia into the mass and use the cement at once. This hardens very quickly. If the meerschaum used is genuine, these methods of repair will be found very satisfactory.

SILVERING METALS

(2186) Q. 1. Leonie Flugarth, Los Angeles, Calif., writes us for information on the silvering of metals.

A. 1. In order to silver copper, brass, bronze, or copper metallic articles, dissolve 10 parts of lunar caustic in 500 parts of distilled water, and 35 parts of potassium cyanide (98 per cent) in 500 parts of distilled water; mix both solutions with stirring, heat to 176° to 194° F. in an enameled vessel, and enter the articles well cleansed of fat and impurities, until a uniform coating has formed.

TEMPERING STEEL

(2187) Q. 1. Elmer Ludwig, Chicago, Ill., asks: How may steel be tempered?

A. 1. The best temperature at which to quench in the tempering of tool steel is the one just above the transformation of the steel, and this temperature may be accurately determined in the following manner, without the use of a pyrometer. The pieces of steel are introduced successively at equal intervals of time into a muffle heated to a temperature a little above the transformation point of the steel. If, after a certain time, the pieces be taken out in the reverse order they will at first show progressively increasing degrees of brightness, these pieces being at the transformation point. When this point is passed the pieces again rapidly acquire a brightness superior to that of their neighbors, and should then be immediately quenched.

1—Heat red hot and dip in an unguent made of mercury and the fat of bacon. This produces a remarkable degree of hardness and the steel preserves its tenacity and an elasticity which cannot be obtained by other means.

2—Heat to the red-white and thrust quickly into a stick of sealing wax. Leave it a second, and then change it to another place, and so continue until the metal is too cool to penetrate the wax. To pierce with drills hardened in this way, moisten them with spirits of turpentine.

LIBRARY PASTE

(2188) Q. 1. Gaius Peters, Wysacossing, Me., asks for a formula for the making of library paste.

A. 1. We are giving you herewith a formula for a paste. It is very similar to one of the well-known office pastes which gives excellent results.

Mix a quantity of a good grade of white flour with cold water into a thick paste, being sure to stir sufficiently to remove all the lumps. Add boiling water, stirring continually until thoroughly mixed and of about the right consistency or slightly thinner. To three quarts of this mixture add one-fourth of a pound of light brown sugar and one-eighth of an ounce of corrosive sublimate. The latter should be dissolved in a small quantity of hot water. When the mixture has colored, a small quantity of oil of lavender may be added. This paste will keep for a long time.

WEATHER FORECASTER

(2189) Leonard Price, New York, N. Y., asks:

Q. 1. How may a simple "weather forecaster" be made?

A. 1. It is known that a leaf of blotting paper or a strip of fabric made to change color according to the hygrometric state of the atmosphere has been employed for weather indications in place of a barometer. The following compound is recommended for this purpose: One part of cobalt chloride, 75 parts of nickel oxide, 20 parts of gelatin, and 200 parts of water. A strip of calico, soaked in this solution, will appear green in fine weather, but when moisture intervenes the color disappears.

Copper Chloride	1 part.
Gelatin	10 parts.
Water	100 parts.

This is a method of making old-fashioned weather glasses containing a liquid that clouds or solidifies under certain atmospheric conditions:

Camphor	2½ drachms.
Alcohol	11 drachms.
Water	9 drachms.
Saltpeter	38 drachms.
Sal ammoniac	38 drachms.

Dissolve the camphor in the alcohol and the salts in the water and mix the solutions together. Pour in test tubes, cover with wax after corking and make a hole through the cork with a red-hot needle, or draw out the tube until only a pin hole remains. When the camphor, etc., appear soft and powdery, and almost filling the tube, rain with south or southwest winds may be expected, when crystalline, north, northeast, or northwest winds, with fine weather, may be expected; when a portion crystallizes on one side of the tube, wind may be expected from that direction. Fine weather: The substance is said to remain entirely at bottom of tube and the liquid perfectly clear. Coming rain: Substance will rise gradually, liquid will be very clear, with a small star in motion. A coming storm or very high wind: Substance partly at top of tube, and of a loaflike form, liquid very heavy and in a fermenting state. These effects are noticeable 24 hours before the change sets in. In winter: Generally the substance lies higher in the tube. Snow or white frost: Substance very white and small stars in motion. Summer weather: The substance will lie quite low. The substance will lie closer to the tube on the opposite side to the quarter from which the storm is coming. The instrument is nothing more than a scientific toy.

FINGER NAIL COMPOSITION

(2190) Mr. Erich Wagner, Milwaukee, Wis., writes:

Q. 1. Can you tell me what chemical ingredients our finger nails are composed of? I would also like to know if this composition can be duplicated so as to give the equivalent of the material of which finger nails are formed.

A. 1. Our finger nails are a hardened skin or epidermal structure, which cannot be duplicated by artificial methods. The general composition is carbon, 51%; hydrogen, 7%; nitrogen, 17%; oxygen, 22%; sulphur, 2%—3% without considering decimals. Perhaps celluloid or a casein product might serve your purpose, in which case we would advise you to address Donnelley Service, of 28 W. 33rd Street, New York City, for names of manufacturers who may be able to supply you with necessary material. Keep in mind that celluloid is very inflammable, almost explosive.

PIN-HOLE CAMERA

(2191) Bayard Wiest, Jamestown, N. D., requests:

Q. 1. Information concerning the making of a pin-hole camera.

A. 1. The distance from the pin hole to the plate in a camera of the type you mention depends upon the size of the hole. This should be experimented with and the hole should be as small as possible. The plate should be as far from the hole as it can be placed and still have the image cover the entire plate.

The best way to make the pin hole for such a camera is in a thin sheet of brass, or tinfoil not iron, as the latter tends to rust. Drill or punch the fine hole to be used and carefully dress the edges on a fine emery stone. This eliminates any burrs which might be left by the drilling or punching action and which would tend to cause blurs on the plate.

The exposure with any camera of this nature should be experimented with as it is almost impossible to set down rules for this work.

Q. 2. Can a 3-inch stereoptican lens be used at all in photography?

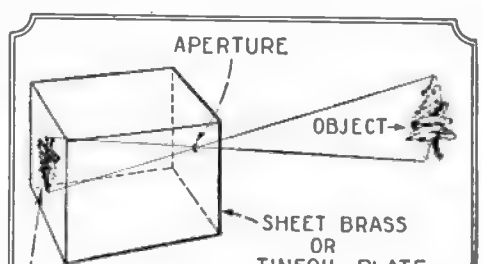
A. 2. The lens you mention can be used for making an enlarging machine.

Q. 3. Please give me the formula for a Kodak film tank developer.

A. 3. A good formula for tank developing is as follows:

Formula for Pyro Tank Developer.

Water	16 ozs.



The above diagram will make clear the construction principles of the pin-hole camera. An inverted image of the original object is thrown upon the plate.

Stock Solution A

Sodium Bisulphate or Potassium Metabsulphite	70 grs.
Pyro	1 oz.
Potassium Bromide	8 grs.
Water.	

Stock Solution B. E. K. Co. Sulphite of Soda (or Hydrometer test 55°) 1¼ ozs.
Water 16 ozs.
Stock Solution C. E. K. Co. Carbonate of Soda. (or Hydrometer test 40°) 1¼ ozs.

To Develop in Eastman Tank

Use for 5x7 size		For 8x10 size.
A	2¼ ozs. :	A 5½ ozs.
B	2¼ ozs. :	B 5½ ozs.
C	2¼ ozs. :	C 5½ ozs.
Water	58 ozs. :	Water 140 ozs.

Develop 15 minutes at a bath temperature of 65° F.

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Edited by
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Should advice be desired by mail a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

NOTE:—Before mailing your letter to this department, see to it that your name and address are upon the letter and envelope as well. Many letters are returned to us because either the name of the inquirer or his address is incorrectly given.

BUILDING BLOCK AND PROTECTION

(1033) A. C. Crockett, Detroit, Mich., asks if he can get a patent on a new type of building block, the nature of which is not disclosed, and also if such a patent will prevent anyone else from manufacturing a similar article.

A. 1. It is very difficult for us to tell you whether or not your concrete building block could be fully protected. We advocate, therefore, that you have a patent search made on the same to determine whether you could get basic protection.

Having patented the article, it does not necessarily follow that others may not make the article. The chances are that any reputable concern would not run the risk, but a few small shops, that have nothing to lose by such procedure, might imitate your product. Nevertheless, anyone making a similar article could be prevented from continuing its manufacture if you notify them that they will be subject to suit and an accounting, or if you instituted such suit.

FAN-HUMIDIFIER

(1034) M. S. Chapman, Chicago, Ill., requests our opinion of a humidifying fan, the nature of which is made clear in the answer.

A. 1. The idea advanced by you, namely to have a piece of absorbent cloth placed in front of an electric fan with the end of the cloth dipping down into a trough of water for the express purpose of humidifying the air in a room is not new and if you will refer to some of the back issues of Science and Invention Magazine you will find that articles on this same subject have appeared in print.

Fans of this nature are on the market in France and in England, although they have not as yet found favor in the American home.

We are doubtful that you can obtain a patent on this subject and are quite sure that a broad and basic patent could not possibly be obtained.

PENCIL ERASER

(1035) August Heeb, Carlstadt, N. J., claims to have submitted an idea for a new type of pencil top and eraser to a large pencil manufacturing concern, but received no reply. He asks whether we think the manufacturer will make use of the idea and also asks whether other similar suggestions have been tried.

A. 1. It is very difficult for us to advise whether the manufacturer will take your idea and make use of it or whether he has thrown it into the waste paper basket. We believe, however, that you are entitled to a reply and would certainly advocate that you write to the manufacturer again.

There are paper pencils on the market now which contain rubber for a considerable distance and the paper can be removed the same as when sharpening the pencil, thus exposing a second portion of the eraser. Modern erasers on the ends of pencils can be removed and others substituted for them. Still another type of eraser is in the form of a soft rubber cap, which fits over the end of the pencil.

We do not think that your particular article is very much superior to those which are now in use.

PERPETUAL MOTION

(1036) J. McDowell, Winnipeg, Man., Canada, asks if perpetual motion has been discovered as yet and if there is any reward for its discovery. He states that he has a theory, but does not wish to go to the extent of making a model if there is nothing to be gained thereby.

A. 1. For more than four years Science and Invention Magazine has had a standing offer of $5,000.00 which will be paid to the individual demonstrating a working model of a perpetual motion machine. This publication desires no rights to the invention whatever. They are merely interested in seeing a practical demonstration of the mechanism and of being permitted to examine this to the extent of preventing any trickery. All rights to the invention remain with the original inventor and due credit will be given to the inventor and his discovery by publication in this magazine. Such publication would establish his claims of priority.

The reason that this award was announced was primarily to protect investors in such mechanisms in the United States. There are many inventors claiming to have discovered perpetual motion. These individuals sell stocks in an invention which will not operate. As their excuse they claim the need of finances for patenting their idea in the United States and in foreign countries. It is obvious that the award of $5,000.00 (which would be made to the inventor producing the working model) will more than finance any patent applications. It is further apparent that publication of the suggestion in a magazine of the reputation of Science and Invention would be of inestimable value to the discoverer.

Several classes of machines are not acceptable in this contest as they do not show perpetual motion. At the present time there are clocks which operate because of atmospheric temperature changes. These clocks have bars of metal serving as the motive power for the clocks. Practically every day in the year there is a change of several degrees in the atmospheric temperature which causes the metallic bars to expand or contract, winding the clock spring. Barometric pressure changes can likewise be made to operate mechanisms and any device employing this principle is also excluded from the contest. Mechanisms operating by tides, winds, water-falls, natural evaporation, humidity, or solar energy may not be entered. They are not a source of perpetual motion, even though the energy could be stored up to take care of times when there is no appreciable effect by any of the power forces. Thus in the northern regions even the tidal forces could not be utilized because of heavy frost.

Of course, it is necessary that the device be a machine. One could submit a bottle of air and claim that molecular activity in the bottle is perpetual motion. From this particular type of device no power whatever can be obtained and such a theoretical system would automatically be barred.

It, therefore, follows that any perpetual motion device entered in the Science and Invention Magazine Contest must work by either gravity, buoyancy, or from a force developed within the mechanism itself, as, for instance, the conversion of mechanical to electric power and the conversion of the electric current and potential in turn, to power or other similar systems.

The machine itself need not develop more power than that required to run the mechanism.

Up to the present time, perpetual motion has not been discovered.

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What the Typewriter Told

By RAY CUMMINGS

(*Continued from page 325*)

had evidently kept the revolver secretly about his person—though he was the last man who would use a weapon. And there in the den, he had drawn it, and dropped dead with it in his hand. With the letters Marberry found this little book, his diary." The Doctor produced a small red book. "This and the letters, gentlemen, tell us the whole—or nearly all—the pathetic story. Look here—I'll read you extracts."

ANONYMOUS LETTERS

THE letters were all anonymous. Mailed at irregular intervals, they dated back over a period of some five weeks. All of them were posted either in Maple Grove, neighboring towns, or New York City. A series of threatening murder letters. Blackmail—the threat of kidnaping, or killing the child. Then the open threat of murder, the child and himself as well. The Doctor explained them, and then opened the diary. Its early pages were the usual diary record. Then came the date of the first of these letters; and from then on it was the unburdening of his heart toward this sinister thing that had come to him. And all of it he had kept secret. The Doctor said solemnly:

"You have only to read these letters and the diary to know why he kept it secret. Men of sterner nature would have gone to the police at once. But not McIlray. Listen to this—the first letter:

Articles In August "Radio News"

"Motorboating"—What It Is and Why, by O. D. Westcott.
The Case for the Headphones as Aids to Reception, by Chas. M. Adams.
The Strobodyne Receiver, by Lucien Chretien.
The Stroboscope, by Hugo Gernsback.
A Double Impedance A. F. Amplifier, by G. C. B. Rowe.
"How's Your Wavelength," by John L. Reinartz.
The Simple Stroboscope, by R. E. Lacault.

"'L. C/. You don't know me but I know you damn well. You read this letter and then I guess you'll figure on turning it over to the police right away. Well don't you do it, L. C. You burn it and keep it to yourself. If you don't . . .'"

A rambling letter. The Doctor read it through—a full page of it, single spaced. And the thing carried conviction. It was obvious that the writer knew McIlray almost intimately. The letter told him of things he had said and done which convinced him of that—convinced him that the writer was close to him. And the letter threatened, if he took the affair to the police, or breathed a word of it to any living soul—that his little daughter would be killed. If he spoke to anyone, this enemy would know it—even if members of his own family. And if he took the child away, had her guarded, or made any change in her daily life or his own, it would be known at once and the child would be killed. But if McIlray played fair—donated to the writer a reasonable sum of money to be named later—no harm would come to Elsie.

A series of such letters. And reading them, no one could have doubted their menacing sincerity. A later one specified a thousand dollars, which the father was to bring to a designated place at night. The money was nothing to McIlray compared to even the smallest danger to Elsie.

The diary showed that McIlray had tried to laugh off the first letter. Some crank, fanatic wanting to annoy him. He tried to

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forget it—but he did not tell the police, or anyone, evidently. Then other letters came. The Doctor read from the diary:

"Whom can I trust? God knows, this could be anyone. It *could* be my wife—my son? But it is not, of course. It could be—one of those I think is a friend. It *must* be one of those. Dare I give this to the police? Of course I must."

But still he did not. A fanatic defied—he recalled having read of many cases where swift death overtook the unfortunate victim who dared fight back. How could he dare take even the slightest chance? He would pay the money asked. He took the money, alone on foot to the place named. But no one was there to claim it. And the next letter said that the writer had decided a larger amount would be necessary. Five thousand now. But when McIlray obeyed instructions, though the letter said a man would appear to take the money, no one was there.

The Banker demanded, "Why didn't this blackmailer find some safe way of taking the money and go ahead and take it? What object——"

The Doctor waved the question away. "Here is the last letter. 'L. C. Well, so you defied me. That's all right too. But I keep my word—this is the end. I ain't the person to go back on what I say. Well when you get this here note you'll be dead five minutes after. An your kid will be dead in an hour. You can't stop me, an I'll get her too, don't you think I won't. This is the finish.'"

The Doctor said, "But he didn't defy him, gentlemen. McIlray never showed the least defiance."

The chemist began, "You mean——"

"I mean," returned the Doctor with sudden vehemence, "that the thing is obvious. McIlray's condition was generally known—that for him to suffer any great agitation would be dangerous—that any sudden shock would kill him. This writer knew it, of course. Made no attempt to collect any money. Wrote 'So you've defied me,' just to bring the thing to a climax—to convince McIlray that himself and his little daughter were in immediate deadly danger. The whole thing—a dastardly attempt to murder a man by frightening him to death—and it succeeded."

THE WRITER IDENTIFIED

THERE was a momentary silence in the club-room when the Doctor paused. "There's the whole story, gentlemen. Naturally the first thing was to identify the writer of the letters. Marberry could not. A questioning of McIlray's family and intimates—there are not so many of them who could have written the intimate details these letters contain—ordinary questioning brought nothing.

"But Mr. Manton here—" The Doctor gestured toward one of the Club members—"Mr. Manton has made a hobby of typewriting—or I should say a science of it. He has given us absolute proof of who wrote those letters——"

The Doctor raised his hand to check half a dozen eager questions. "Wait, gentlemen! In a moment you shall hear how we got that proof. But here is the point: To identify the letter-writer does not prove premeditated murder. Or murder at all. The criminal may very well say, 'Why all I wanted to do was get some money out of him.' We must prove the *intent to kill*. And this case is unique because the murderer did nothing which in itself could prove his intent. You get the point? Nobody can say from those letters—as a matter of cold legal proof—what was in the writer's mind when he wrote then. His actual planned intent to accomplish what actually occurred, is necessary—his planned intent to frighten McIlray to death—that is what we must prove."

"You can't prove it," the Lawyer exclaimed. "Unless you can get a confession."

The Doctor smiled. "I'm having several of these people brought here tonight—they should be here by now. The criminal is

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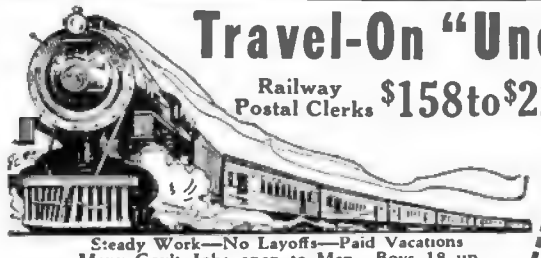

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among them—he does not yet know that we have any proof against him. That's why I included others whom he might think we suspected . . . Gentlemen, understand me. You'll see presently that this blackmailer—murderer—is what they call hard-boiled. And by his appearance you would never suspect it. A queer character—emotionless—or at least impervious to any emotion which we could induce in him to make him betray himself. Marberry has studied him. We know we cannot make him confess—unless we confront him with positive, irrefutable proof. Then, if we have judged him rightly, he'll confess quite calmly."

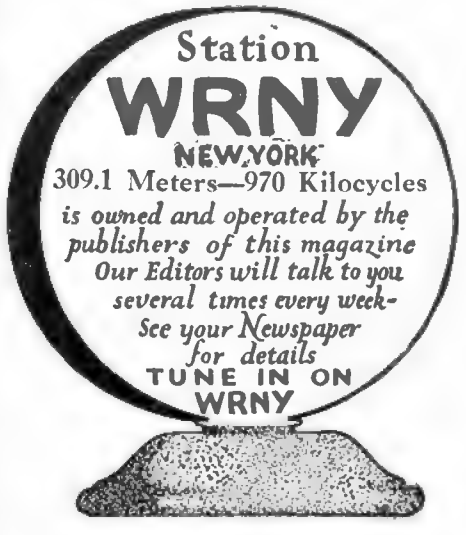
"But the proof?" demanded the Lawyer. "How can you prove the intent in his mind? Nobody knows what was in his mind except himself."

"We can prove it," the Doctor said. "You'll see. Now the way Mr. Manton identified who wrote the letters is——"

The Banker interrupted. "Who did write them? If he intended murder not blackmail, what was his motive?"

Before the Doctor could answer the door opened and an attendant announced, "They are all here now, Dr. Adams. Shall I bring them up?"

The Doctor nodded. As the door closed he added briskly, "You gentlemen are to do nothing except sit quiet and listen . . . You have the evidence, Marberry?"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The detective answered that he had. "Good," said the Doctor. "Well gentlemen, you'll hear in a moment how we identified this letter-writer, for I'm going to explain it to him bluntly. His motive—we have guessed it—and I believe we can now drag it forth. With you as witnesses—the unusualness of this hearing—I think we can get proof of the motive. Not from this hard-boiled murderer—from someone else more susceptible to surprise. That will strengthen our case. And then for our final proof of premeditation——"

THE INQUEST

HE got no further for the door opened and the visitors entered. The murder letters lay scattered on the table, but the Doctor made no move to gather them up. Four men and a woman advanced into the room. They were introduced to the Club members, the Doctor making brief frank explanation to his fellow scientists regarding each of them.

The woman was Sibyl McIlray, wife of the dead man. A tall, slim woman of thirty-two, fashionably dressed, with her luxuriant chestnut hair coiled on her head. A stunning woman—in her own estimation—and to do her justice, in the estimation of almost everyone else. Her manner was friendly, though reserved; but there was in it now as she acknowledged the introductions, a hint of patronage, almost of snobbery.

Taking his seat near her, though he

seemed to ignore her with the suggestion that a secret animosity might have been between them, was Alan McIlray, the dead man's son by his first wife. A good-looking young man of the promising business type. Of four years service in the Tonola Company, in spite of his youth it seemed likely he would be raised to his father's position.

Beside Alan, sat Raymond Worthington. He was editor of one of the Tonola House Organs, occasional ad. writer, and general proof reader of the mass of printing the Advertising Department issued. A slim, Byronic-looking man—poetic with his pale skin, dark eyes and longish, wavy black hair.

Next was Frank Boyce, copy writer and all-around man of the Advertising Department. A man of about thirty-five. Solidly built, with a smooth-shaven, ruddy face, pale eyes, sandy hair and a bald spot. He seemed to smile overmuch; an air of geniality, of which doubtless he was proud, radiated from him.

And last, John Haynes, who kept the records of the voice trials, and wrote for the Advertising Department all its copy of an artistic musical angle. A small man, with a red-brown skin, dark eyes, a rather flat, broad nose, and sleek, oily very straight black hair. A likable fellow, this Haynes—he was well liked in the Tonola Company. Some said he was half American Indian, or of native West Indian descent. Mrs. McIlray considered him a negro.

Such were the vistors, one of whom, the Doctor had said, was this murderous criminal. To the listening Club members, it was obvious that all these suspects used typewriters in their daily routine. Except Mrs. McIlray, and she had been a stenographer. She had not given it up, but as a point of fact, had now in her home a small portable machine upon which she typed her social correspondence.

When the visitors were seated, Sibyl McIlray, in a voice cool, gracious, but with annoyance undisguised, demanded abruptly:

"May I ask, Dr. Adams, what your purpose is in this? So—public a gathering—my time is limited——"

Her glance was on the letters lying on the table. Each of the visitors had glanced at them, recognized them from times of various police questionings.

The Doctor answered smilingly. "I asked you all here for an informal unofficial inquiry into the death of Mr. McIlray, as you know. I shall be brief—blunt—even hasty, you may be sure." He paused an instant, and then plunged at once into the heart of his attack.

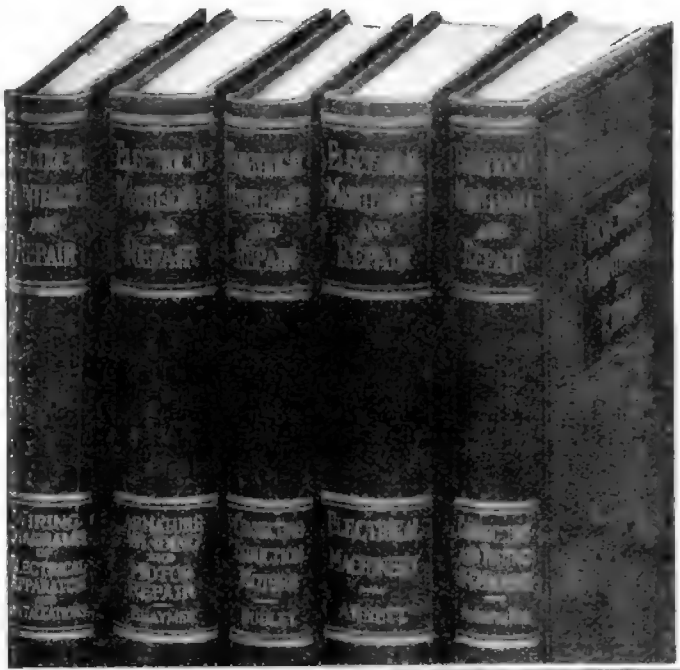
"These letters—" He gestured toward them—"shocked Mr. McIlray and caused his death. As you know, the police suspected one of you five as the writer of them——" They received it quietly. Not one of them moved, or spoke. Mrs. McIlray raised her pencilled eyebrows and smiled superciliously. "They suspected you," the Doctor reiterated. "They still do—but their grilling was unavailing, and they had no proof. We of the Scientific Club, however, now have proof! We know now which of you wrote those letters!"

THE PROOF

IT struck them like a bomb, surprised, startled them. Yet the keenly watching Club members could detect only the normal startled aspect, not the woman, nor anyone of the four men showed guilt. Frank Boyce ejaculated, "By Jove, this is interesting"; and smiled his genial smile. It was out of place; so much so that Alan McIlray, himself very sober, leaned over and audibly whispered, "Shut up, you fool!"

The Doctor went calmly on. "We know which of you wrote those letters. I'm going to tell you how we know . . . Mr. Marberry, close that door, please."

The detective closed the only door to the room, locked it ostentatiously and dropped the key in his pocket. He said grimly, and



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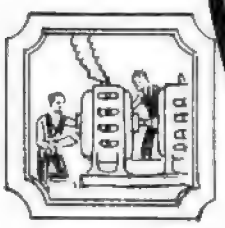

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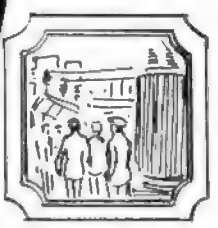

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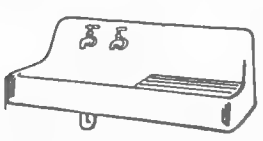

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with a faint ironic smile, "Those windows—remember we are nine stories above the street. This guilty person will do well to sit quiet. We ask no confession."

Haynes the Indian, with expressionless impassive face, murmured, "Is one of us supposed to leap through a window? I think this is going to be what they call the third degree."

"You're mistaken," said the Doctor. "I'm not going to question any of you. We have all the proof we need . . . I'll continue. The problem, briefly, was this: We had a series of anonymous, typewritten letters, attempting blackmail, threatening murder. We had five suspects, all of whom use typewriters daily—all of whom had the knowledge, the intimate facts concerning Mr. McIlray which would have enabled them to write the letters. Which one—if indeed any of them—was the letter-writer? Mr. Manton here, found out. Let me tell you how."

Raymond Worthington said abruptly, "Why don't you accuse one of us at once? It would save the rest of us from a good deal of apprehension."

"I shall conduct this as I choose," retorted the Doctor with a frown.

Worthington smiled. "Excuse me. I merely implied that you might make an error—accuse the wrong one. Those of us who are innocent naturally are apprehensive."

"There will be no error," said the Doctor . . . "An examination of the letters, gentlemen, showed that they were all written by the same person and upon the same machine. Tricks of phraseology, when analyzed, showed but one author. Mr. Manton determined also that the illiteracy of the letters probably was assumed. That was fairly easy to see. Illiteracy is hard to simulate. You have only to examine some real specimens of illiterate letters to see that these are false. The writer then, we reasoned, was a person of education.

"Next, that all were written upon one machine—that too was simple. Typewriters differ—even those of identical make—and more especially after they have become old. Pica type, elite type—different types and different ribbons. Also less blatant differences—some which you cannot notice without a magnifying glass. Letters out of alignment—or a corner of the letters chipped off. These blackmail, murder notes all show the same machine peculiarities—so we know that they were all written upon the same machine—a rather old, decrepit one.

"Now, of course, had this criminal been such a fool as to use his own machine at the office, we could have identified him by that. But he did not. He had some hidden machine, naturally, and since we had no way of finding it, the peculiarities inherent to the typewriter did us no good . . . I'd prefer that none of you interrupted me, if you please. I'll be through in a moment."

Frank Boyce had started to speak. The Doctor now wholly ignored the visitors, addressing himself to the Club members. "You gentlemen will realize that the differing work done by different typewriters is the same as with different pens in handwriting. In each case—the pen, the machine—they are merely the tools. A stub pen writes a broad stroke; other pens write quite different strokes. Some old pens scratch; some stick in the paper on the ascending stroke. All are mere peculiarities of the tool being used. "But gentlemen, you all know that in handwriting we do not identify the writer by the pen he used, but by the personal characteristics of his writing. So it is with typewriting! Not so generally known. This criminal did not know it. He considered his machine, but not his typewriting. We have handwriting experts. Mr. Manton here—shall we call him a typewriting expert? He has made a study, a science of it."

The Doctor's words were creating a sensation. But nevertheless, not one of the five visitors showed guilt. The woman was visi-

(*Continued on page* 364)

How Lindbergh Navigated Atlantic

(*Continued from page 298*)

operates on a different principle from the pivoted magnetized needle compass, has been coming rapidly to the fore.

One of the accompanying diagrams shows the make-up of the inductor compass, and also its position when installed on Colonel Lindbergh's plane. As the plane sweeps along through the air, it causes either a small propeller blade or else a cup shaped air screw to rotate a dynamo armature, the insulated copper wire winding of which is similar to that of any ordinary armature, with the excepton that it is wound on a laminated wooden core instead of an iron core. The lead wires of the various coils from the armature winding, are connected to a regular copper bar commutator, having about twenty-four segments in the present models. Silver contact brushes bear against the commutator, and the brushes can be rotated through any angle. All parts are made of non-magnetic material, excepting the ball bearing rings supporting the shaft of the rotating armature. The rotating inductors or copper wires in the slots of the armature, cut the lines of force of the earth's magnetic field and cause an electromotive force to be set up or developed in the rotating winding. The average speed of the rotating armature is two thousand revolutions per minute. The rotating armature is placed in a non-magnetic casing, as the pictures show, and this in turn is supported in gimbals so that it is free to maintain a level keel whether the airplane is flying on the level, ascending or descending, as one of the illustrations shows.

The *course setter* lever and dial on the instrument panel, is connected through a flexible steel shaft to the brush frame inside the dynamo casing, so that the position of the brushes can be changed in accordance with the course to be flown. The inductor compass indicating instrument is a galvanometer of about forty ohms resistance, calibrated to read with a zero center, and the letters L for left; and R for right, on the dial. The inductor compass dynamo works in wind streams of from 70 to 130 miles an hour velocity.

The earth inductor compass, pictured herewith, which Colonel Charles A. Lindbergh said was his greatest aid in navigating from New York to Paris, is based upon a simple electrical principle, although it may appear complicated to the layman. The compass measures the angle between the brushes of the generator of the compass and the earth's magnetic field and enables the pilot to set his course at any angle to these lines of force, which point to the magnetic north.

The inductor compass was invented by Morris M. Titterington of the Pioneer Instrument Company, and is installed on all planes to be used for long distance flights. It is of great value on all parts of the earth's surface. It is particularly valuable in polar flying, where the earth's field is very weak and ordinary compasses will not function.

The compass consists of three parts: the generator, the controller and the indicator, which is really a galvanometer. The generator is a direct current generator, having no artificially induced field.

The controller is a purely mechanical device, connected to the generator through the shaft and casing. Rotation of the controller causes rotation of the brushes of the generator, and dials on the face of the controller show the angle through which the brushes have been rotated in relation to the airplane.

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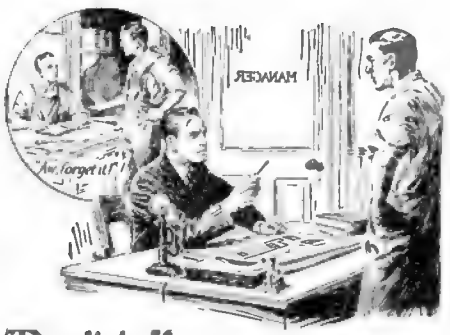

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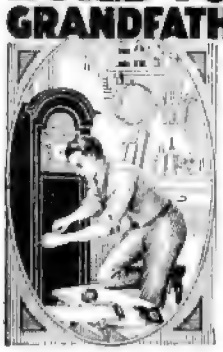

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The operation of the compass depends upon the rotation of the armature of the generator, which cuts lines of flux of the earth's field and generates electricity. Its potential depends upon the angular relation between the brushes and the direction of the earth's field. That is, the output of the generator is a function of the angle between the position of the brushes and the magnetic north. Fig. C. As the generator is assembled, the output is maximum when the brushes are in a north-south position, Fig. A, and zero when they are in an east-west position, Fig. B.

For proper functioning of the compass it is simply necessary that the direction which corresponds to one of these positions of zero potential be set on the dials of the controller. To determine any unknown direction one rotates the controller, and correspondingly the brushes, until the indicator reads zero and then reads the direction from the controller dials.

The usual method of steering by this compass is to set the desired heading on the controller and then to steer to keep the indicator on zero.

The compass is affected by the magnetic variations just as the magnetic compass is, but it does not swing and jiggle with the motion of the ship as does the magnetic compass. Allowances have to be made for these variations, but Colonel Lindbergh had carefully calculated these and made proper correction. The entire compass, generator and all weighs only thirteen pounds.

SAILING THE GREAT CIRCLE

One of the principal arguments concerning Colonel Lindbergh's air flight from New York to Paris arose over the path that he followed. Without looking at a globe, and particularly if one looks at a Mercator projection of the earth's surface, it will appear that the straight and shortest path between New York and Paris would be anything but the path followed by Colonel Lindbergh, but as pointed out by an expert of the National Geographic Society, the Colonel really saved 474 miles by flying along the great circle course. The course directly east from New York to Paris via the Azores amounts to 4107 statute miles, while the course outlined by a string if stretched tightly between New York and Paris across New England, Canada and Newfoundland, across the south of Ireland to Paris, the route actually followed by Colonel Lindbergh, shows us a distance flown of 3,633 statute miles. Thus the hero flyer saved 474 miles or the difference between these two. A glance at one of the usual Mercator projections, and also at a properly proportioned may, shows that the Colonel's course was practically along a straight line between New York and Paris, but on the Mercator projection it appears to be a far out of the way course and much longer than a true east course.

One of the untoward features of the trip was the sleet storm into which he ran which might have resulted disastrously, but for the fact that he rose above this storm at times and came through unscathed. It has been suggested that for future designs of long distance planes, the hot exhaust gases from the engine might be caused, to pass through pipes extending along the front of the wings, so as to preclude the possibility of sleet piling up on the wings and struts, and probably forcing the pilot to descend due to the weight of the accumulated ice.

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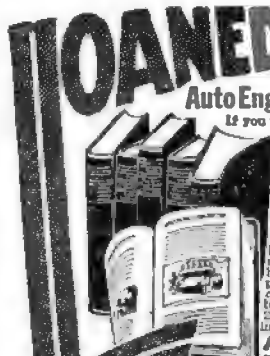

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The Romance of Modern Carpet Making

By JOHN V. SMEALLIE

(*Continued from page* 316)

V with its point pointing toward the observer. In the space between the cords forming the bottom of the V and the cords forming the top of the V, the loom operator inserts a piece of the Chenille cord and he works this clear across the loom with his fingers, pulling the cord through to the far end. Locating this cord properly in accordance with the design, he combs it into place with a comb made of metal, resembling the average hair comb. The weavers thus assist the beater-reed to perfect the closely woven fabric. Every time that one of these Chenille cords is inserted, the loom is stopped for the hand tufting operation (Fig. 19). This method permits custom made rugs to meet almost any requirement for size and shape, character of the yarn and height of the pile.

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Home Mechanics

By W. M. BUTTERFIELD

(*Continued from page* 327)

ing the bottom of the lip on the top frame. This ring serves to keep the air out of the box, just as a similar ring keeps air out of a fruit-jar.

A rich sandy loam is the best soil for growing plants in the box; the supply should come about ¼" above the top of the tank, and should be well fertilized with humus, bone meal, etc. before it is put in. The plants can then be set out to suit the taste or fancy of the builder. One fairly good sprinkling of water should be sufficient to start the box going in good working shape. Ventilation is provided for in the removable top, which can be slightly lifted—the corners supported on match-sticks, or wholly removed, to dry up excess moisture in the box, for if the leaves of the plants begin to decay, or mold appears on the surface of the soil, it is evident that too much moisture is present.

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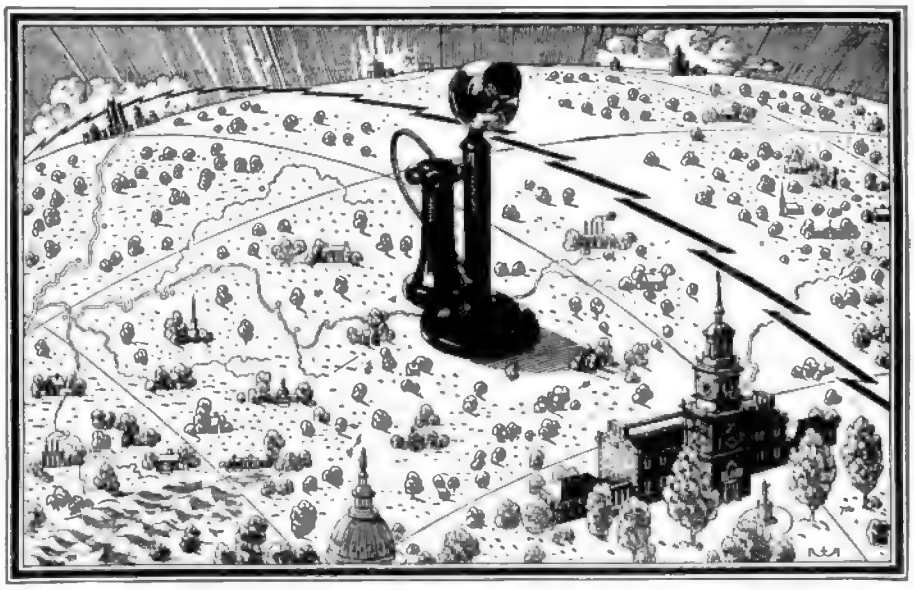

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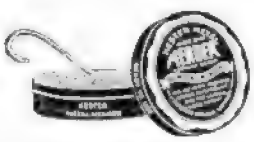

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What the Typewriter Told

(*Continued from page 360*)

bly excited. Three of the men were tense, with what even to one innocent, might have been a normal apprehension; but the Indian still was impassive. The Doctor had said that this criminal was hard-boiled. It seemed so indeed.

"The science of identifying typewriting," the Doctor continued, "I believe will develop into great importance in criminology—and hitherto it has been neglected. I won't weary you with details—here are, briefly, its fundamentals—to give you an idea of what I mean. In studying the work of different typists, we have good work, poor work, erasures, x-ing out letters and words. Those are general characteristics such as of a good or a poor penman—but they are not specifically individual. However, in addition, inherent to all the typing a person does, is an individuality quite comparable though of course not so obvious to the untrained eye, as handwriting. Some of the individualities can be seen at a glance, others only by scrutiny under a magnifying glass. But they are always there.

"Here are some of them. A typist may obviously use the professional touch system. but the stroke will be rather weak with the fourth finger of each of the hands. Most generally that finger, for the ligament tying it gives it less freedom of action than any of the others. The weak stroke, however, might be any finger. Whichever it is, it remains always the same—and since, with the touch system each finger has its allotted letters to strike, the peculiarity can be identified. Under a magnifying glass the least difference of power in the stroke can be discerned.

"Or again. A typist may have an offending finger; and, when making a very light letter, will frequently back space and strike the letter over again. That is readily noticed. Or, an inexpert typist will use the 'hunt and peck,' involving but two fingers at the most of each hand. Such a typist may only use the left hand shift key, and needing a capital letter at the left of the keyboard, will reach over with his right hand and give it a strong poke with his forefinger. Easily seen and recognized."

Frank Boyce, with the grace this time not to smile, murmured, "I wonder which one of us does these things."

The Doctor ignored him. "Another will thump his period unduly hard. A rapid typist again, sometimes goes too fast for his machine. The simple combination of t-h-e—his impetuosity will cause him to strike the t-h so rapidly as to run them inordinately close together—the escapement not quite keeping pace with him.

"Or sometimes, with the combination of a comma followed by a space, a typist of unprofessional training will develop a peculiar ultra-rapid touch, using the right forefinger and the thumb. Even a machine in very good shape will frequently jump two spaces when that is done. A typist prone to that peculiarity will in a single page have that happen several times, yet another typist, using the same machine, would never have it happen.

"You follow me, gentlemen? I might go on with these individualities for a long time—Mr. Manton has tabulated nearly a hundred. But I think I've given you enough to show you what we mean. It is true that a typist with extreme care, could disguise or correct many of these peculiarities. The two-space jump, for instance, could readily be watched and avoided. But this anonymous letter writer had no such thought. And he was absorbed with the difficulty of simulating illiteracy. Content that he was using a secret machine, he typed in quite his normal fashion.

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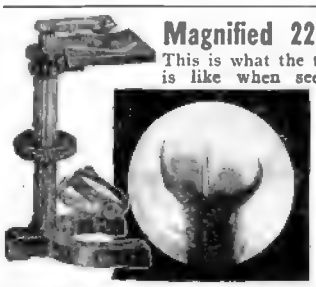

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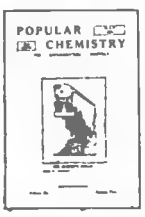

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"Another point. A single sentence of typewriting gives nothing conclusive. It is the average over a large number of sentences. Fortunately in this case, the anonymous letters give us ample length. And you will realize, of course, that for comparison, we had no difficulty in securing from the Tonola office voluminous specimens of typewriting of these four men."

THE ACCUSATION

THE Doctor's tone turned suddenly grim and menacing. "Gentlemen, there is absolutely no possibility of error. So obvious a result that any twelve jurors will see it at a glance. Each and every one of these anonymous letters—how many peculiarities, Mr. Manton?"

"Nine," responded Manton quietly. "I have tabulated them, marked them in the original anonymous letters."

"Quite so. Nine, gentlemen, no more, no less. Nine—always the same nine in each of the murder notes. We then take the office specimens—the work of four different typists. All have peculiarities—some the same peculiarities in common. But only one of these four typists has that exact set of nine, and *he has them*. That exact set of nine—no more, no less. Is there any room for doubt, gentlemen? The evidence is here, irrevocably typed, mathematically beyond any coincidental possibility."

Manton, at a signal from the Doctor, had produced a sheaf of yellow typewritten pages, office copy of ads, House Organ editorials, articles on the merits of the phonograph, and the like. Pages marked with Manton's penciled notes. And a tabulated list of explanations appended.

The club members leaned forward. Several of the visitors were on their feet. All recognized the authorship of this office copy. Alan McIlray leaped forward. With this assailant of his father now exposed, the son's wrath played forth.

"You damned murderer. They got you. Got you—"

He was bending over Raymond Worthington; would have attacked him but the detective forced him away. Worthington kept his seat. His face was paler than usual. Sweat was on his forehead, but he forced a smile.

"Murderer?" His voice was calmly, cynically questioning. There was a tremor in it, but it did not break. "Murderer? as I understand it these letters attempt to blackmail. They make idle threats, nothing else. I see no evidence of murder."

The detective was back upon him. "You admit the authorship?"

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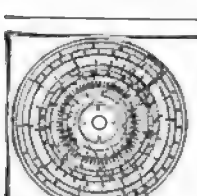

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The Doctor interposed, "He doesn't have to. We've proven it against him. Let him alone—it will go harder with him if he maintains innocence in the face of this evidence."

There was a brief pause, then Worthington made a gesture. "I'm not a fool. I wrote the letters, yes." He had better control of himself now. One of those usual characters whose looks wholly belie their nature. One would have said this long-haired poetic-looking Worthington would have been emotional in the extreme. Yet he was not; was indeed, coolly calculating; his mind now, undoubtedly busy, deciding upon the course to give him the best standing possible with the law he soon would have to face.

"I wrote them," he reiterated. "Make the most of it. My intention was to get some money out of him. He paid me too little in the office." He simulated a momentary vehemence. "I knew he was in delicate health, but forgot it. My God, if I'd realized the letters might shock him—might jeopardize his life—even so, my conscience is clear as to that. I only wanted money. I didn't get it, but I'll admit I tried to."

"We sympathize with you," said the Doctor ironically. "Gentlemen, this fellow knows what he is doing—he's calculating every word. He murdered Leonard McIlray—premeditated murder—and he thinks we cannot prove it. He has had experience with the law—been sentenced twice in England for forgery and petty thievery. You didn't know we were aware of that, did you, Worthington?"

"No," he said calmly. "But since it's a matter of record, I admit it freely."

The Doctor turned away, swinging abruptly to Mrs. McIlray. The woman, to one watching her closely, had been acting very strangely. One might have thought, with this assailant of her dead husband at last unmasked, she would have been triumphant, wrathful of him as was her stepson Olan. Instead she was obviously frightened, apprehensive, with a fear not for herself, but for this Worthington, now trapped and in the hands of the law. At his admission of guilt, "Raymond," in agonized cry had burst from her. The Doctor, who had been observing her more closely than he had the man, now swiftly confronted her, his manner menacing, his voice grim with an edge of steel.

"You know why he did this thing. His motive—you supplied it."

She looked up to him; the color faded from her cheeks, leaving them grotesque with their vivid rouge. His gaze held her as he went on.

"This Worthington is in love with you. You knew it; you reciprocate it—admitted to him your love."

She stammered, "I—why he—" Then resolutely stopped.

"Your friends suspected it," the Doctor went on. "Since we proved this fellow the letter writer, Marberry has quietly been questioning them."

The detective jumped forward, confronted her. "Yesterday you very nearly told me so yourself. You tried to hide it, but you're guilty—I knew it yesterday—guilty as hell."

They would not give her time to speak. The Doctor put in, "Your little daughter Elsie knew it. There's where we got the real information. Knew it, without knowing, thank heaven, what it meant. She told us—told me she overheard you and Worthington. Heard him ask, 'If you were free, Sibyl, would you marry me?' And you said, 'Yes, yes, Raymond, I would.'"

THE MOTIVE

THE Doctor swung away. "There is the murder motive, gentlemen. This woman, inheriting the bulk of her husband's estate, would be at his death comparatively rich. Technically a virtuous wife, but she loved this cad—admitted to him that if she were

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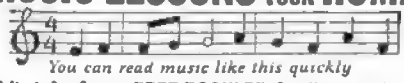
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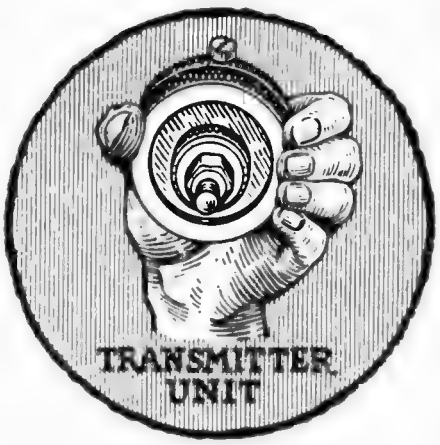

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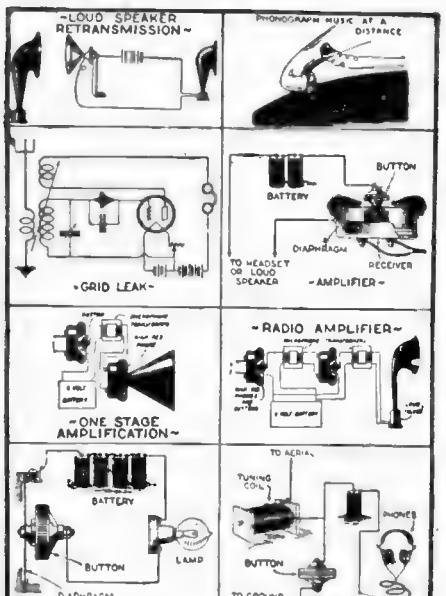

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free she would marry him. Sealed—unwittingly her husband's death warrant."

The Detective exclaimed: "Elsie heard you say that. You did say it, didn't you? Do you dare deny it?"

She was confused; on the verge of sobbing. "You—you mean—" she half whispered. "You mean, I tried to kill my husband. That's not—"

"Of course not," the Doctor interrupted. "I said the contrary. You could not—or did not—know what this Worthington would do. But you admitted you loved him? Told him—if you were free—you would marry him? We do not blame you—no blame—you meant nothing—"

She broke down. "I mean nothing—that's true. But I did love him—not my husband. That's true. It's all true, what you say."

"Sibyl!" It was a cry of angry warning from Worthington, but she was sobbing and too overwrought to heed it. "I meant nothing wrong—before God, I meant—and I did nothing wrong. I—I could not help loving him. And I told him so—but I told him I'd never divorce Leonard. He was good to me. Good to me, and now he's dead."

The Doctor left her. She was sobbing uncontrolled; and Alan McIlray led her aside, with obvious revulsion yet man enough to comfort her.

The Doctor again fronted Worthington. "So you see, we now have your motive for premeditated murder."

Worthington was gripping the arms of his chair. His eyes roved the room as though instinctively he sought escape. Then they fastened upon the Doctor's face. He sneered.

"The woman's a fool."

"She was, but she isn't any longer."

"You think you could make anyone believe that hysterical story?" He was forcing an argumentative tone, striving to appear at ease.

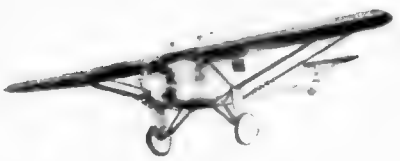
The Doctor responded calmly, "Of course, and they'll believe the child and the corroborative evidence of everyone who knew you and her."

Worthington's gesture was resigned. "Have it your own way. Say I had a motive. That proves no crime. I swear I intended nothing but blackmail by those letters. You can't prove what was in my mind. I know, and you don't."

"Oh, yes I do. And I can prove it. I will—here and now—mark you, gentlemen—as soon as we knew this Worthington was the criminal we set about finding his hidden typewriter upon which he wrote the notes. He has never been near it since he wrote the last one on the morning of McIlray's death. Naturally he would stay away from it. But to trace his former movements and find it was a simple though laborious piece of detective work. The murder notes were mailed in several towns adjacent to Maple Grove, some in Maple Grove and some here in New York. That last one postmarked noon, was posted in Rollinsdale. It is a fifteen minute trolley ride from Maple Grove; the trolley passes the Tonola factory.

"Marberry found by inquiry, that Worthington left the office about ten-thirty that morning. He has no automobile; and he was observed to take the trolley. It is a branch line; it goes nowhere but to Rollinsdale. From ten-thirty until noon—only an hour and a half—Marberry assumed that Worthington might have gone to his secret typewriter, written and mailed the letter. Mailed it hastily near at hand, near noon and this would, by Worthington's calculations, deliver it in the Maple Grove late afternoon delivery.

"Merely presumptive reasoning on Marberry's part—that the typewriter was in Rollinsdale—but it proved to be correct. The rest was easy. Worthington, most naturally had hired a room or small office somewhere in Rollinsdale. Probably under an assumed name. But Worthington is a distinctive type—easy to describe, and Rollinsdale is a small place. Marberry, accom-



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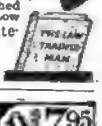

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panied by myself with two other assistants and Mr. Manton, made a canvass. We found in a cheap boarding house that a man named Blaine, who answered Worthington's description, was renting a room, not sleeping in it, but occasionally using a typewriter. He had said he was an author.

"We found the typewriter, took possession of it. We have it here—an old, battered machine. It has a broken letter which appears in all the murder notes. Additional, clinching evidence. Does this interest you, Worthington?

"Very," he replied, with a faint touch of sarcasm. But his face was even paler than before. The sense that he was trapped must have been coming to him. He added cautiously: "You say you have the machine here? May I see it?"

The Doctor nodded. Marberry had already crossed the room, opened a closet, returning with an old, somewhat dilapidated typewriter, which he placed on the table. Worthington regarded it without emotion; then he gave a mirthless laugh.

"That's the one I used. That landlady will of course identify me and the machine, so I admit it, naturally. But, Doctor Adams, this is all to no purpose. I wrote the letters intending blackmail, nothing more."

"We'll see about that," said the Doctor grimly. A tenseness came to his voice; and it spread, this tenseness, about the room as though his hearers realized that now he had come to the climax of his attack.

"Gentlemen, the vital point now is—did Worthington write these letters merely for blackmail, or with *intent to kill.* We have established that he had a strong motive to desire McIlray's death. But that proves nothing. Did he have in his mind as he wrote, a definite intent to kill? Gentlemen, look at that typewriter, notice it has a nice new black ribbon on it—not the ribbon which was used for the murder notes. That ribbon tells the story! It has been used only once—part of it not at all."

The Doctor pointed to the typewriter which stood now on the table with the electrolier shining full upon it. "On that ribbon, gentlemen, you will find the impressions made by typing upon it just once. A short note—so short that there was no occasion to reverse the movement of the ribbon. The letters are quite legible. Like a sheet of carbon paper used but once, or a new blotter used once, it contains the letters, words, sentences which were impressed upon it."

The Doctor was talking very rapidly now. Worthington had risen to his feet and then had sunk back to his chair.

"Mr. Manton and I very carefully transcribed those words. They were written *previous to Mr. McIlray's death;* remember that. We have positive evidence that Worthington never again returned to the typewriter after that morning. The ribbon shows us a letter to his darling Sibyl. He wrote it; we found in it that same set of his individual peculiarities. A love letter, which he wanted to look nice with a new ribbon, and it states that now that *her husband is dead,* soon she will be his. A foolish letter to write. Doubtless he concluded so and never sent it. But he wrote it, *before his victim died.* That almost proves intent to kill—perhaps not quite. But, gentlemen, when he finished the letter, he typed—possibly upon another piece of paper—or possibly having then decided not to send the letter, he added it as a postscript. With morbid desire, doubtless to see how the words would look, and then destroy them, as of course he thought he did. The words, *'I hope I kill him—I want him to die—I'll be so glad—glad—'* Is that premeditated murder, or isn't it? He put what was in his mind there on the ribbon!"

The room was in confusion. Worthington sat clutching the arms of his chair. A stupid, fatuous grin was on his face, but his eyes were wide with terror. His composure wholly gone, he stammered:

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"Why—why, that's a lie. I never wrote—"

The Doctor stood before him. "You see we've got you."

"No. Everything else you said was true. But this—this is a lie. I never saw the ribbon—"

A sardonic smile was on the Doctor's face. "Think well what you are saying, you know we'll use it against you. That ribbon contains your own individuality of typing."

For a moment Worthington was silent, struggling to master the emotion which had suddenly surged over him. "No," he said; and his voice now was calmer. "I never saw that ribbon. It wasn't on the machine when you found it."

"It was."

"Then you lie."

"Oh," said the Doctor, "do I? You forget—fortunately, Mr. Marberry was with me. So was Mr. Manton. Three of us together. That's good testimony that we found the ribbon. Your word, since you're being so highly technical, wouldn't go far against the oaths of the three of us."

Worthington eyed him. Again the man seemed coolly calculating, but his fingers gripping the chair arms were writhing.

The Doctor added, "You've had experience in pleading with the law. Think well. This is premeditated murder—you're going to the chair—I'll swear to that—"

"If I only had a lawyer." Worthington muttered as though to himself. "Say nothing—not now—only it's a damn lie—"

The Doctor caught the words. "There's a lawyer here. You see, I'm trying to settle it now."

A vague smile came to Worthington's bloodless lips. "I'm not a fool—your lawyer—"

"Not my lawyer—a member of the club who happens to be here. You know the ethics of the legal profession—you know you may trust him—Mr. Royce."

Worthington got somewhat shakily to his feet. "You're right. You're no fool either. Damned clever, and damned—"

"Thank you," said the Doctor. "I want to be fair with you—fair but just."

Worthington flashed him a look; and sat apart with the lawyer, whispering earnestly. Once he looked up and demanded:

"Are you going to present this evidence? Not give me a chance—"

"You deserve nothing," responded the Doctor sternly, "and you know it."

"You'll swear to it? To all this evidence?"

"I will."

The lawyer said, "Will you, Sergeant Marberry?"

"Yes," said the Detective.

"And you, Mr. Manton?"

"I will," Manton said. "He's lying to you—his last desperate stand. We found that ribbon—"

The lawyer turned back. Again they conferred. Then Worthington spoke. "He tells me you have here the man who will be my prosecutor? You've thought of everything, haven't you? Do I understand that if I plead guilty—first degree murder—I won't get the chair?"

"You'll get it if you don't plead guilty," the Doctor assured him. They bargained. The young District Attorney could promise nothing except that he would do his best.

"Life," said Worthington. He said it with a sort of desperate weariness. "You've got me. Would I get off with life?"

"I think you would," the Assistant District Attorney agreed. "I'll do my best to save you."

"And—lifers have been pardoned? Good conduct—"

"Assuredly. It's your best course, Worthington."

He hesitated. Those near him heard him mutter, "That damned ribbon. But they've got me." He added aloud, with a snap of decision, "I'll plead guilty. Shall I sign it now?"

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They wrote him a confession. He signed, and presently the detective had led him away. The Doctor gazed at the closing door with a faint smile.

"The typewriter told us many things, gentlemen, thanks to Mr. Manton. All of them were true—up to the finding of that ribbon. You see, we were morally certain of his intent to kill, but we could not prove it. So we forged that last vital link in the chain of evidence ourselves. He was the type of criminal who bargains with the law. We knew that from his record in England. We did not find that typewriter ribbon. He did not write those fatal words. But Marberry, Manton and I convinced him we would swear that he did, and he knew his best course was to yield."

The faint smile was still upon the detective's lips. "Would we have sworn falsely had he stood us off? I do not think so—I should not want that on my conscience. But he did not stand us off, because he was guilty. An innocent man would have held out to the end. And there, gentlemen, is something to think about. Guilt is always handicapped. You need only to know how to take advantage of its inherent weakness—and you have it beaten."

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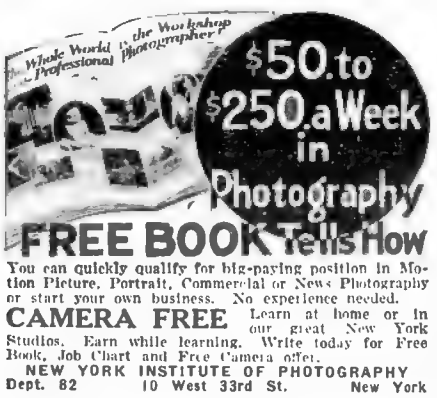

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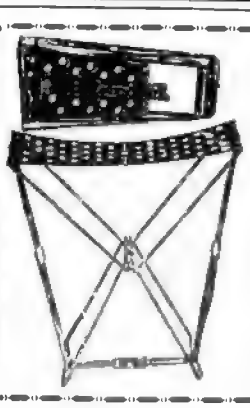

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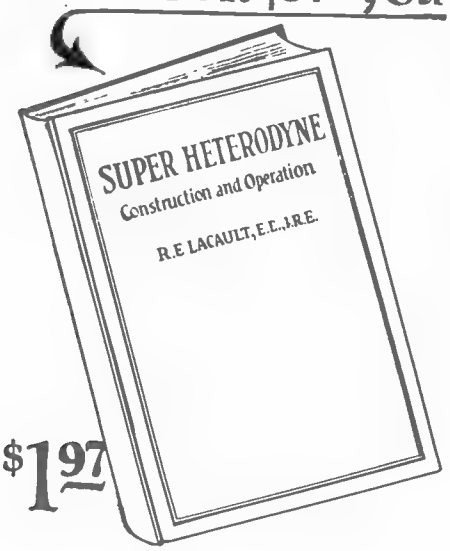

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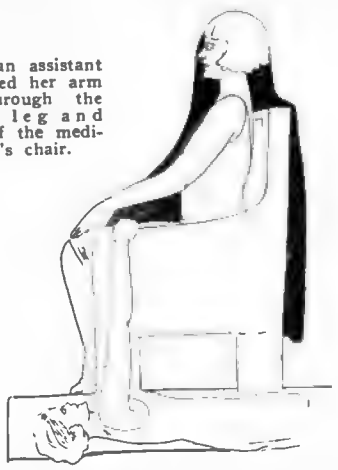
By DUNNINGER

(*Continued from page 317*)

beginning of the séance was finally announced. The visitors proceeded to seat themselves in a circle. The scarcity of chairs necessitated many seating themselves upon the floor, and making themselves comfortable upon the many pillows placed there for their convenience.

The lady of mystery nestled herself in th large throne chair, as Emma proceeded to place three or four slates upon the lap of the medium. Several bells, and a tambourine were also placed along side the slates. One of the oriental servants brought forth a cloth of heavy black silk, daintily embroidered, adding an additional touch of the far East.

To the sound of an organ in a nearby room, several hymns were sung, and the medium entered an apparent trance. Emma now threw the large cloth over the head of Miss Bosworth, completely covering her form from view. Two small holes near the lower end of this cloth, permitted the medium's hands to project, allowing them to thus be in clear view of the audience at all times.



How an assistant extended her arm up through the hollow leg and arm of the medium's chair.

In a soft, sweet voice, Emma explained that for those who were skeptically inclined, the arrangement was quite convincing that the medium could move neither her hands nor her feet, unless such action were detected by the audience. The cloth extended only sufficiently over the body of the medium, so as to permit the feet of the medium to remain in constant view. The hands were likewise continuously exposed through the two holes in the cloth, so it was quite evident that if any manifestations presented themselves, they were of spirit control; inasmuch as the medium was helpless in offering any physical assistance.

The organ continued to play. Dead silence predominated. Contrary to my expectations, the lamps were not lowered. Several moments elapsed. Suddenly Miss Bosworth began to moan. A quivering beneath the cloth, directly above her lap, was apparent. Distinctly the sound of bells were heard . . . then the tapping of tambourines. Suddenly the instruments sprung around forcibly beneath this covering. After several moments of musical vibration, the bells and tambourine suddenly fell to the floor. These were quickly picked up by Emma and handed to one of the Jap maids, who carried them out of the room. During this time, the medium's hands, which were, of course, constantly in view, twitched nervously. Her slim white fingers moved about, and occasionally her hands assumed the position of a closed fist. It was plain to see that these hands were really flesh and blood, and not an imitation,

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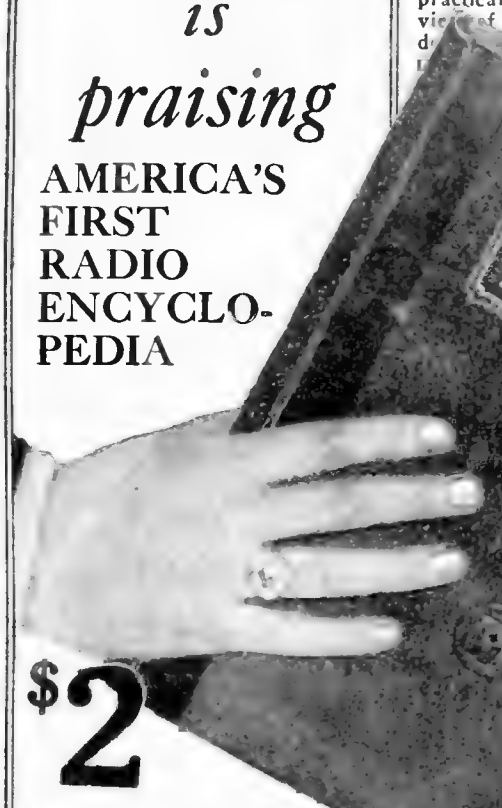

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as some probable skeptic might have concluded. Various new-comers were asked respectively to name any one in the departed sphere from whom they would like a message. Several of the ladies and gentlemen spoke up and called various names aloud. I naturally partook in this performance, and called the name of Henry Manning.

Several moments elapsed. Motion beneath the cloth was evident. As it subsided, Emma reached beneath the cloth, and produced one of the previously examined slates, and thereupon was a message from one of the dead. This was handed to one of the "regular customers," who read it, and was apparently pleased. The lady acknowledged that she recognized Florence's handwriting. The vibration again continued. The spirits were at work once more. Emma produced another slate from beneath the cloth, and there was another message. This one was read aloud. It came from two spirits. The names were rapidly acknowledged by two of the sitters.

These proceedings continued until several messages were thus produced. A fresh set of slates were now examined, and stacked upon the wonder-lady's lap. Under cover of the cloth, more action was evident, and more messages came forth. Finally we received a message from Henry Manning. He wrote how happy he was, and how much he missed me. He told me that he was anxious to reorganize our friendship at some later date. All of this puzzled me considerably, inasmuch as I had never known anyone by that name intimately. The name was a fictitious one, which I had merely called to test the medium's ability.

After many more moans and groans, Miss Bosworth awoke from her apparent trance. The cloth was now removed, and there sat the lady, apparently exhausted from her great strain. Many of the spectators arose from their seats, and questioned the medium closely as to her condition, apparently much concerned about her health. A glass of water was quickly served to Miss Bosworth by one of her attendants. All in all, the picture was perfect. One thing must be said, in credit to this lady for her amazing performance. She was truly a marvelous actress. She overlooked nothing in the line of stage-setting, atmosphere, or effect. She more than satisfied her clients, all of whom left quite convinced and well satisfied with the demonstration in general.

"How, then," you will ask, "did the medium cause these bells to ring . . . how was the vibration produced? Who wrote the messages upon the slates, and how did the manifestations in general take place?" The medium did them all herself, dear reader . . . each and every one of them. "How, then," you ask, "were both her hands in view constantly, through the holes in the cloth, that covered her form from view?" Quite true . . . two hands were evident, both of flesh and blood, but only one of these belonged to our wonder-lady. The other hand, as the diagram discloses, belonged to a girl, who pushed her arm up through the leg of the throne chair. This young lady was concealed in the room below, and pushed her arm through a small opening in the floor, up into the hollow of the leg of the chair. The highly carved and ornamented framework of this structure well concealed the small trap, through which the hand made its entrance and exit. Rather a tedious position for one's hand, I will admit, but considering the very profitable business that the medium was conducting, it is likely that the lady was more than well compensated, both for her assistance and silence in the matter. It is simple to conceive that all of the writings and the bell ringings were accomplished by the free hand of Miss Bosworth, concealed beneath the silken cloth of mystery.

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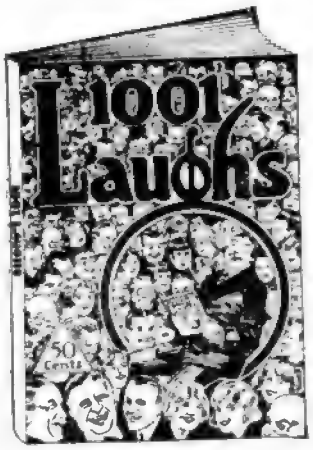

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Traceless Poisons—Nonsense

By UTHAI VINCENT WILCOX

(*Continued from page* 313)

poison mentioned therein which he decides to use. The next problem is how to procure it. If he goes to his druggist, the druggist will probably never have heard of it. If by some freak of fate the would-be poisoner does get hold of one of the drugs of fiction, the chances are that he can dose his mother-in-law until she dies of old age.

"The layman then decides, as ninety per cent of all poisoners do, to fall back on one of the good old standbys, either white arsenic or potassium cyanide. He goes to his druggist and tries to buy one of these. He is refused on the ground that what he is trying to buy is a deadly poison. He will probably try other drug stores with various stories about desiring to kill a dog or rats. Perhaps he will at last find one that will sell the chemical to him. But at the same time he will be forced to sign a book kept for this purpose in the drug store, and he can also be certain that the druggist will remember his exact appearance if any case of poisoning should develop in the neighborhood.

"Yearly the restrictions on the sale of dangerous drugs grow increasingly strict. Strychnine, atropine, phosphorus, arsenic, and the cyanides are practically the only ones that a layman has a chance of procuring. And even on these he is carefully checked.

"Even in the industries where a certain amount of chemicals of a poisonous nature are used a close check is kept on the stocks. In fact there is probably today a great deal more industrial poisoning than there ever has been of a private nature. Everyone remembers the wave of deaths that followed experimental work with a new gasoline mixture and everyone knows that there are certain industries characterized by their deadly nature.

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"Friends have often asked what would be the perfect poisoning technique in these times. Supposing a man had a connection that he wished to be rid of, a rich relative or an admirer of his wife, as in most poison cases. Supposing he invited this person to a party at his home and into a bottle of bootleg whisky slipped some wood alcohol. At the present time such a poisoning would come as close to being perfect in nature as possible. To be sure, it would be obvious that the poisoner's victim had died of wood alcohol poisoning. But everything would point to it being an ordinary bootleg whisky death and as to obtaining deadly alcohol, any would-be poisoner can take it out of his car's radiator.

"In recent years much has been made of germ poisoning and the impossibility of detecting such poisoning," said Mr. Smith, author of "Famous Poison Mysteries," published by the Dial Press. "There have been three recent American cases in which it was charged that germs were used to remove an undesirable. In the case of Colonel Swope it was charged that typhoid germs were administerd. The same was charged in the death of John E. Peck, Michigan drug millionaire and also in the Shepherd case, where it was not proved.

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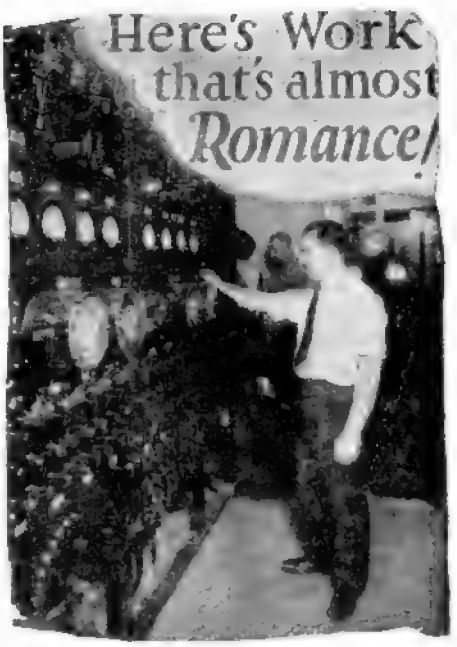

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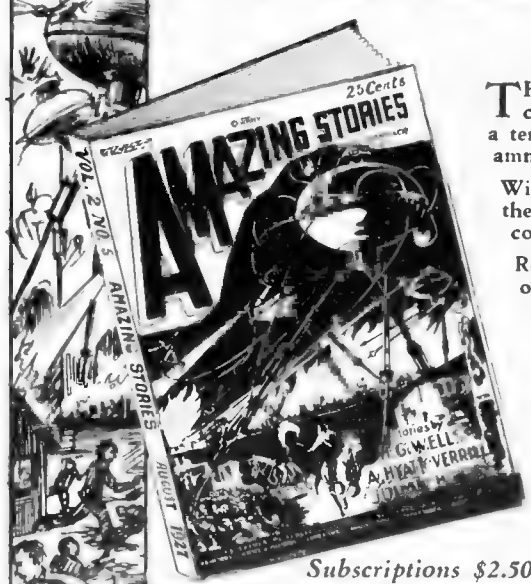
The WAR of the WORLDS
By H. G. WELLS



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What Chance Has Your Baby?

By H. H. DUNN

(*Continued from page* 300)

writer, "I found a gradual reduction of the sex-ratio through the early years of childhood. In some places, the female death rate even exceeds that of males for a few years in later childhood. In several countries, though not in all, it is greater during the period of child-bearing. After this, the male rate of mortality again exceeds that of the females. In the advanced-age groups, there commonly are more women than men."

Differences in the mortality of the two sexes are due in part to the *circumstance of sex*, and in part to the *different conditions* (i.e., environment) under which the sexes live, according to Dr. Holmes. Because of these varying and various conditions under which the sexes live, especially in later life, and which modify what scientists know as the "natural incidence" of sex mortality, Dr. Holmes has confined his studies largely to infants dying in the first year of life. The results of this study become of particular value as a basis for preventive measures against epidemic and endemic—otherwise known as "general"—diseases during that early period.

With these differences in the mortality of the sexes, Dr. Holmes couples differences in the distribution of deaths in a population, which are due, he deduces, in part to accidents of environmental influences, and in part to variations in hereditary endowment. This leads directly to the thought that, since some diseases undoubtedly are hereditary, and that there may be hereditary predisposition to other diseases, there is also a selective death rate. This points in turn to evolutionary action and development in man, since it has been found by a long series of studies and tabulations that a high death rate in the first year of life is counterbalanced negatively by a low death rate for the same group of children a few years later.

"The inference to be drawn from this," said Dr. Holmes, "is that if there is a high death rate in the first year, a larger proportion of weaklings are eliminated, and the remainder, on the average, are better able to withstand the vicissitudes of future years. Into this condition, also, enters the factor of the immunization of the child survivors of an epidemic, such as diphtheria or scarlet fever, which, even though it caused no selective mortality, would render children immune to these diseases later on, and, therefore, would tend to reduce the average death rate."

Fundamental differences of sex are determined by the peculiarities of the chromosome complex characteristic of males and females, and are, therefore, due to hereditary factors. It is Dr. Holmes' conclusion that the greater mortality of the male is an action of natural selection in discriminating against one sex on the basis of the endowment received from its ancestors through heredity. Amplifying this thought, Dr. Holmes said:

"Primarily, the differences in male and female mortality are *due to heredity;* they are an expression, directly or indirectly, of the complex of hereditary factors with which each sex starts its existence. To a certain extent, perhaps, the lowered vitality of males may be due to recessive sex-linked genes. Most sex-linked characters in man are recessive, and hence are much more frequently found in males."

In other words, the elimination of the male at a comparatively early period in life, such as is commonly noticed in insects and in other forms of life more easily studied than man, seems to persist in man. This may not leave the "female of the species

(*Continued on page* 377)

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"SAFETY RAIN PAD"

Some time ago I noticed a copy of your magazine on a newsstand at 6th Avenue and 18th Street. I grabbed it in the hope of finding a side line to pay some bills and return some borrowed money.

It contained a formula for a Safety Rain Pad. Being an Auto Mechanic by trade I seized this opportunity.

My first sale was a tremendous success. The first day in active selling I made $4.50 from the pads.

I am enclosing a subscription to MONEY MAKING as I may forget to buy it at the newsstand.

ALEX. KULIK
Detroit, Mich.
COMPILING NAMES

This letter is written in honor of the possibilities of your magazine. Some time ago I bought your November issue in which I read the article "Money in Names." Having access to a number of names in my business, I started to work in my spare time.

During the month of November I made $508.10 total profits selling names to shopkeepers.

Besides this I have a steady monthly income from this source.

May your magazine have prosperity forever.

JACK YOUNG
Rapid City, S. D.
BEAUTY FORMULA

I was broke, forlorn, disgusted with life. While passing a store I noticed "SPARETIME MONEY MAKING."

Hoping against hope I studied the copy from cover to cover.

I decided to sell a beauty cream by Mail Order.

My local town paper allowed me a small ad on credit. The second day brought 1 sale, the third 4, and so on until today I made $31.00. From the wonderful success I am making I expect to make this my life occupation.

Thanks to "SPARETIME MONEY MAKING."

A. W. HILL
Downington, Pa.
TOWN PAPER

I was in need of some ready funds quickly. I had no capital with which to experiment.

In searching the pages of "SPARETIME MONEY MAKING" I came across an article on co-operative advertising.

I secured a plain sheet of paper (his sole initial investment) and made a 4-page folder called the Town Booster, ruled off with certain spaces for ads.

Then I proceeded to sell the ad spaces to merchants on a guaranteed mailing list.

In just one week after reading the article in "SPARETIME MONEY MAKING" my "Boosters" were in the mail and my net gain for the week's sparetime work was $117.00.

K. W. HICKEY
Wichita, Kan.
MEDICAL SERVICE

I have been a steady reader of SPARETIME MONEY MAKING and each month I find many valuable suggestions which I keep to try them out when the weather affects my regular roofing business.

It occurred to me that there was a wonderful opportunity in the article "Operate a Medical Service Bureau."

Working along the lines suggested, I make many profitable connections with town papers, Doctors, etc.

I went into this as a sideline, but, since it is proving such a splendid money-making proposition, I have decided to spend all my time at it.

My newsdealer saves me a copy of SPARETIME MONEY MAKING each month. I would not be without it, as every article is worth many times the price of the magazine.

E. L. STEVE
Fordson, Mich.
DOUGHNUT BAKING

I have been a reader of your magazine for three months. While reading through your magazine I noticed the ad of the Food Display Machine Corp.—to make "Brown Bobby" Greaseless Doughnuts.

Having a very small capital, I decided to try their "Junior sized machine."

I took my first batches to the factory where I work and passed them around.

Now I am selling 12 dozen daily in the factory and many dozen for private parties.

My net profit was $64.68 for 1 month requiring 2 hours of my Sparetime each evening.

SPARETIME MONEY MAKING — 15c ON ALL NEWSSTANDS

Subscriptions only $1.50 for 12 months

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THE CONSRAD COMPANY, INC. 230 *Fifth Ave., New York*

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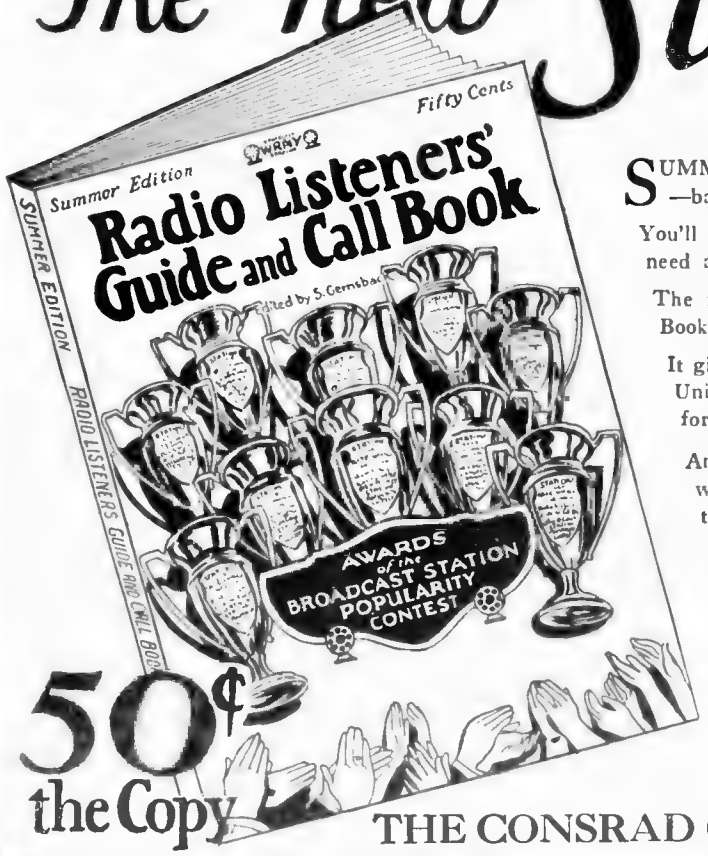
Fifty Cents
WRNY
Summer Edition
Radio Listeners' Guide and Call Book
Edited by S. Gernsback
SUMMER EDITION RADIO LISTENERS GUIDE AND CALL BOOK
AWARDS of the BROADCAST STATION POPULARITY CONTEST
50¢ the Copy

SUMMER is here—with the big outdoor features on your radio—baseball, fights, stadium and band concerts.

You'll want all you can get of course. But to get them all you'll need a brand new up-to-date call book.

The new "Summer Edition" of Radio Listeners Guide and Call Book is as new as the season. Bright and fresh from the press.

It gives the very latest revised list of all broadcast stations of the United States, Canada and foreign stations. Arranged with spaces for writing in your dial readings.

And don't forget—there are a dozen or more brand new circuits written up for home construction. See the list of contents on this page.

It's one great edition for each and every radio set user. Contains 176 pages, 100 illustrations on the large magazine size, 9 x 12 inches—and with a beautiful two-color cover.

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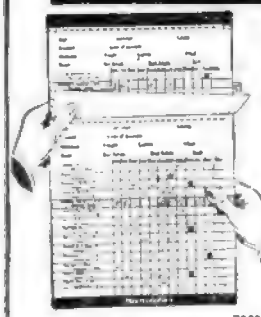

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Color signals "flag" your attention. Cuts record-keeping costs 40%. Quick for use in reference or posting.

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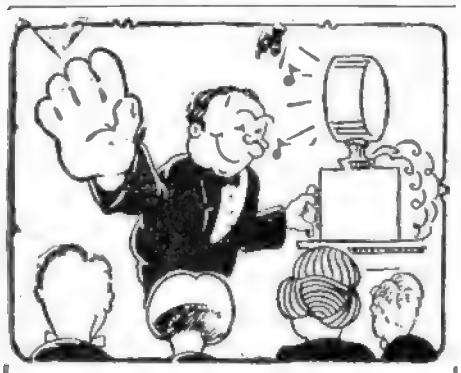

Party Manners!

RADIO Receivers know no rules of etiquette—they cannot be taught to act on best behavior when company and friends are judging them—but they can be made to act properly if the operator understands the few simple factors that effect *tuning* or the proper adjustment of the Receiver's controls.

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Receivers of different types, individual characteristics are handled separately. All there is to know, all that must be known before one can really say to understand the tuning of a set—is given in this book.

25c—EVERYWHERE

If your dealer cannot supply you write direct.

THE CONSRAD CO.

230 Fifth Ave., N. Y.

(*Continued from page* 375)

more deadly than the male," but certainly depends on her for the persistence of the race.

"Then," added Dr. Holmes, "there is the 'Y' chromosome, which never occurs in the female, and, which, therefore, never is entrusted by Nature with the transmission of any traits essential for the welfare of the species. In fact, it is rare that any hereditary trait is clearly dependent on factors carried by the 'Y' chromosome. In Drosophila (a fruit fly) whose 'X' chromosome carries factors for about 200 sex-linked characteristics, the 'Y' chromosome, which is nearly as large as the 'X' behaves practically as an empty vessel."

One of the results of the investigation just completed by Dr. Holmes is to show that infant mortality for the colored population is much higher than it is for the white, while the sex-ratio of deaths among babies is much lower in the negroes than in the whites. This affords a striking illustration of the principle mentioned above that a low sex-ratio of deaths goes with a high infant mortality. For the same reason, the much higher sex-ratio shown since 1914 is a result of the marked decline in infant mortality which has taken place in recent years. From 1914 to 1923, the death ratio for white infants was 131.5 boys to 100 girls, while for colored babies, it was 122.4 males to 100 females.

Equipped with the knowledge that the boy baby has considerably less chance of surviving his first year—or, in fact, any other year—than his sister, parents will be interested in knowing the responsibility of the various childhood diseases for these deaths. In the period under consideration, from 1900 to 1923, the common infectious diseases, such as measles, diphtheria, bronchitis, pneumonia, diarrhea and enteritis, took 124.3 boy babies for every 100 girls. Whooping cough is excepted in this tabulation because it is the one outstanding disease *which carries off more females than males* in the first year of life.

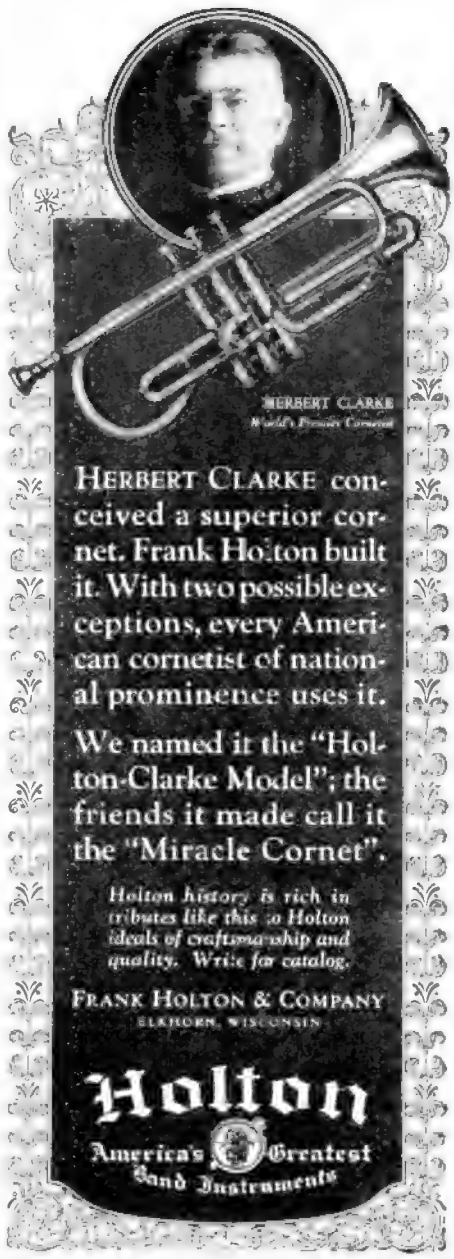
Measles took 123.3 white boy babies and 129.3 colored, as compared with 100 girls, a rather low sex ratio when compared with the average of 128.5. Whooping cough is something of a mystery, because, not only in infancy, but throughout life, it kills more females than males, only 94.2 boy babies dying from it, as compared with 100 girls. This is the only disease of infancy in which the sex-ratio favors the boys. From bronchitis, 128.2 boy babies died as compared with 100 girls. Other ratios, using 100 girl babies as the unit are as follows: tuberculosis, 114; typhoid, 130; diphtheria, 128.4, almost the national average; pneumonia, 124.7; diarrhea, 117.5; dysentery, 116.9; meningococcus meningitis, 120.6; tuberculous meningitis, 131.3; pleurisy, 151.0.

The entire list of infant diseases and causes of infant mortality is contained in Dr. Holmes' tabulation, which shows that the highest ratio of sex-mortality is from hernia, which brings death to 401.9 boys as compared with 100 girls.

"If we follow the sex ratio in infant mortality through the first year," Dr. Holmes commented, "we meet with a very curious fact. While in general there is a reduction of the sex ratio as we pass from birth to the end of the first year, there is an actual increase in male deaths for a short time after the first month.

"Perhaps the clue to this apparently anomalous situation," thinks Dr. Holmes, "is to be found by regarding the phenomenon as the resultant of two opposed tendencies: first, a primary superiority of female vitality, which gradually diminishes *relatively to that of males*, as the age of the infants increases; and, second, the tendency of an increase of mortality to lower the sex ratio.

(*Continued on page* 381)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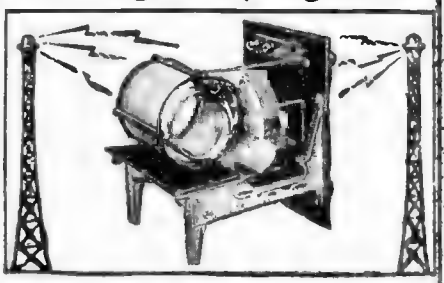
stations crowd the air & spoil your programs



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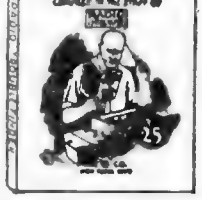

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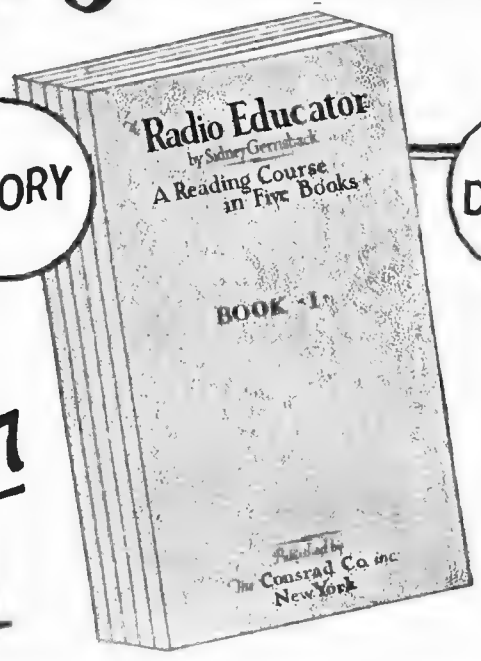

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Electroplating Made Simple

(*Continued from page 334*)

take on an antique green color, the articles can be boiled in a solution of 4 parts of copper sulphate, 1 part of ammonium chloride and 50 parts of water. Copper and brass articles can be colored black by immersing in a solution of half a pint of household ammonia, 10 grams of sodium sulphide and 4 quarts of water.

An odd use to which you may put your electroplating apparatus is in cleaning old files. By making the file the anode, or connecting it with the positive side of the battery in a cold dilute (such as 1:10) sulphuric acid solution, and passing the current so that the surface of the file bubbles freely with gas, the file can be considerably improved in cutting and rasping properties. About five minutes' passage of the current is enough. A large nail or sheet of iron can be used as the cathode, or negative electrode in a sulphuric acid bath when renewing files in this manner. After this treatment wash the files thoroughly in warm water, or preferably lime water, and then dry and rub oil into the teeth.

The Transformation of Cellulose

By DR. ERNEST BADE

(*Continued from page 335*)

this pure nitrated cellulose. These two substances, when mixed together, form a plastic mass which can be molded, rolled, polished, pressed, cut and hammered.

When the lower nitrates of cellulose are dissolved in a mixture of equal parts of ether and alcohol, a thick, viscose liquid is formed which is known as collodion. This dries rapidly when exposed to the air and leaves a thin film behind, and since it has a certain amount of stickiness, it may be used as a cement. This collodion is somewhat brittle, and the brittleness may be removed by adding camphor dissolved in alcohol. This changes the collodion solution into a solution of celluloid which, of course, is quite flexible. The addition of the camphor produces another change, the inflammability of the pyroxyline is reduced.

MARVELS OF MODERN MECHANICS, by Harold T. Wilkins. Stiff cloth covers, 5¼"x8¼", 280 pages. Published by E. P. Dutton & Co., 681 Fifth Ave., New York City. Price $3.00.

The book is quite popular in its treatment. As a sample of the odd things that the author has got together is his description of the smallest railroad on record, which is in Cumberland, England. It is used by visitors to the lake district. The story of the discovery of petroleum sources by the torsion balance originated by Baron Roland von Etvos of Budapest, certainly brings the book up to date.

THE NEW HEAT THEOREM, by W. Nernst, stiff cloth covers, 5½"x8¾", 282 pages. Published by E. P. Dutton & Co., New York City. Price $4.00.

This is a highly technical book covering the theory and experimental data of thermo-dynamics and advancing the author's own theory, which he calls the new heat theorem. This holds for all chemically pure substances of a crystalline nature and the book was commented upon by Prof. Einstein of relativity fame. Much of the experimental data and theoretical acquisitions are combined in this volume. It is illustrated to give the experimentally disposed reader a chance to duplicate some of the experiments mentioned in the chapter on the specific heats of solids. Graphs, formulas, and tables occupy just enough space to enable the student to follow both the experimental work and the theory. A list of the papers closely allied to the same subject published by the University of Berlin, and notes supplementary to the first edition of this same book are contained in the final pages of this treatise.

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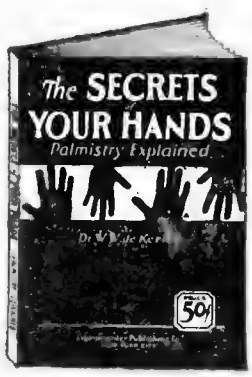

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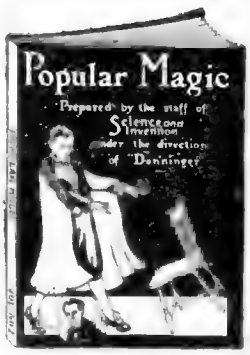

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What Chance Has Your Baby?

(*Continued from page 377*)

Throughout most of the first month, the first tendency may be regarded as the predominant one, *as it is before birth*, but, owing to the fact that so large a proportion of infant deaths are crowded into the first month, the primary tendency is more nearly counteracted by the second than it is in later months.

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"The greater sex mortality of the male probably is just an incidental effect of his maleness. This is certainly true of the greater male mortality of many of the lower animals.

"It should be remembered that death in these cases is a function of both constitution and infection, and that it is the differences in constitution of the male and female, which are greatest in early infancy, which constitute the *discriminating factor* in the sex mortality of our babies."

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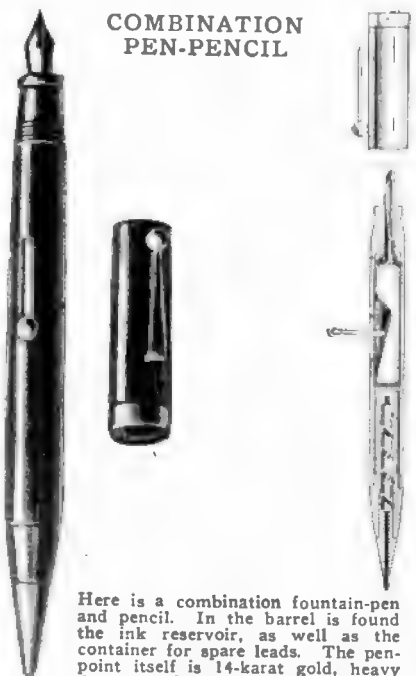

Here is a combination fountain-pen and pencil. In the barrel is found the ink reservoir, as well as the container for spare leads. The pen-point itself is 14-karat gold, heavy duty and tipped with iridium, while the pencil action propels, repels and expels the lead. Six spare leads may be found in the container. Mechanically perfect, this combination is the perfect substitute for the usual pen and pencil carried by the average business man, the average woman or the school boy or girl.

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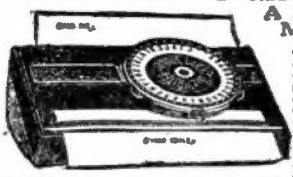

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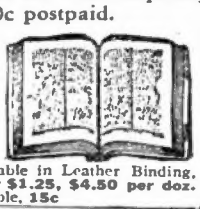

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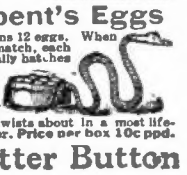

Box contains 12 eggs. When lit with a match, each one gradually hatches itself into a snake several feet long, which curls and twists about in a most life-like manner. Price per box 10c ppd.

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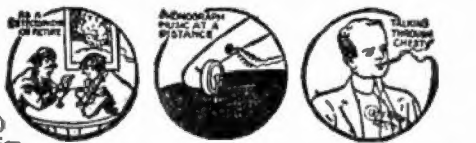

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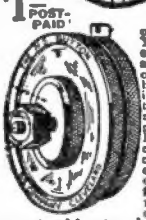

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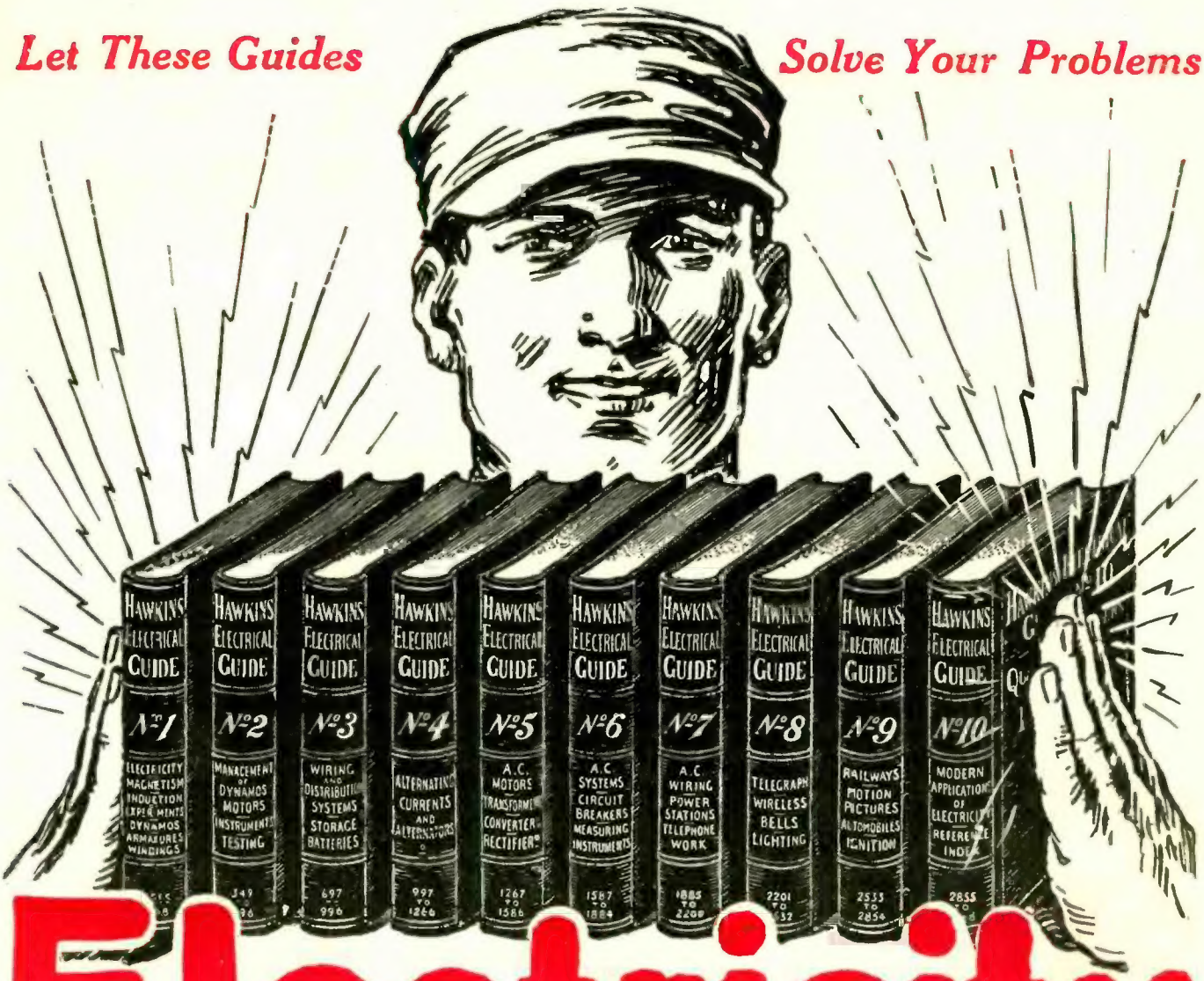

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